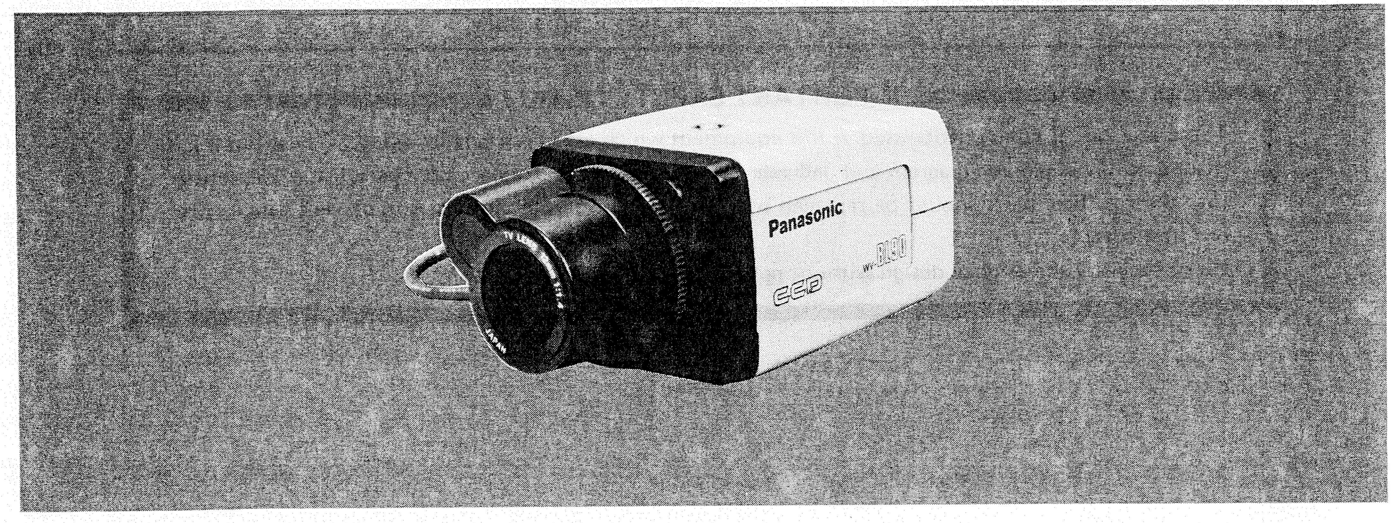
ORDER NO. AVS8903180C8

Service Manual

Solid state Camera
WV-BL90



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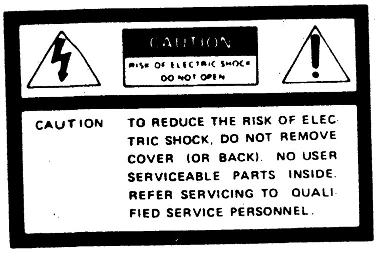
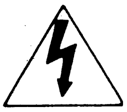
Panasonic

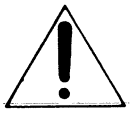
Matsushita Electric Industrial Co., Ltd.
Central P.O. Box 288, Osaka 530-91, Japan


CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN

CAUTION TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.



This symbol warns the user that uninsulated voltage within the unit may have suificient magnitude to cause electric shock. Therefore, it is dangerous to make any kind of contact with any inside part of this unit.



This symbol alerts the user that important literature concerning the operation and maintenance of this unit has been included.
Therefore, it should be read carefully in order to avoid any problems.

IMPORTANT SAFETY NOTICE

There are special components used in this equipment which are important for safety. These parts are shaded on the schematic diagram and indicate " ⚠ " mark on the replacement parts list. It is essential that these critical parts should be repleced with manufacture's specified parts to prevent shock, fire, or other hazards.
Do not modify the original design without permission of manufacture.

SPECIFICATIONS

Power Supply :	To be supplied from the specified monitor WV-BM90 or Camera Drive Unit WV-PS10A or WV-PS104 or Camera Extension Unit WV-83
Pick-up Device :	577 (H) x 581 (V) pixels, Interline Transfer CCD
Scanning Area :	6.4 (H) x 4.8 (V) mm (Equivalent to scanning area of 1/2" pick-up tube)
Scanning System :	2:1 Interlace
Horizonal Scanning Frequency :	15.625 KHz
Vertical Scanning Frequency :	50 Hz

Maximum Distance to the Monitor :

Coaxial Cable Type	Maximum Cable Length	DC R/1000 ft. of Inner Conductor
RG-59/U	270 m	Less than 30 ohms
RG-6/U	670 m	Less than 12 ohms

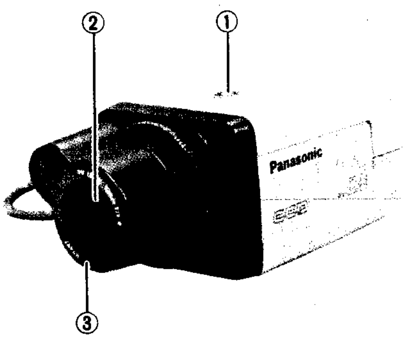
Horizontal Resolution :	420 lines at center
Recommended Scene Illumination:	20 lux
Minimum Scene Illumination :	0.5 lux at F1.4, AGC ON
Signal to Noise Ratio (Luminance) :	48 dB (typical)
Ambient Operating Temperature :	–30°C - +50°C
Dimensions :	74 (W) x 58 (H) x 112 (D) mm
Weight :	350g

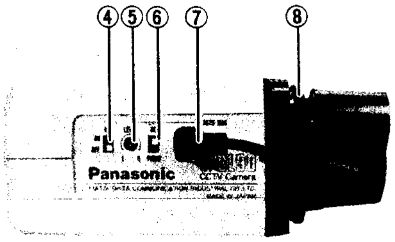
Weight and dimensions indicated are approximate.
Specifications are subject to change without notice.

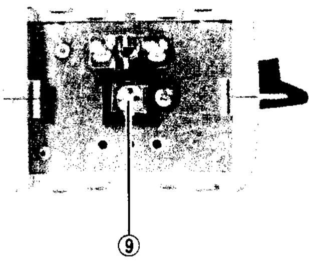
OPTIONAL ACCESSORIES

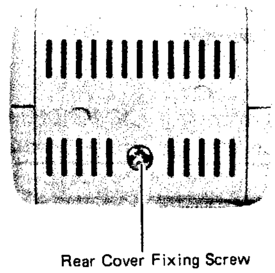
o Video Monitor	WV-BM90
o Camera Extension Unit	WV-83
o Camera Drive Unit	WV-PS10A, WV-PS104
o Auto Panning Head	WV-35A
o Remote Control Unit	WV-32
o Camera Housing	WV-40
o Drip Proof Fan/Heater Housing	WV-46/KT
o Power Supply	WV-47
o Automatic Iris Control Lens	WV-LA2.8 WV-LA4.5 WV-LA6B2 WV-LA12B2 WV-LA18 WV-LA36 WV-LA8B WV-LA16B WV-LA25B WV-LA50B
o Manual Iris Control Lens	WV-LM4.5 WV-LM6B2 WV-LM12B2
o 6X Automatic Iris Zoom Lens	WV-LZ81/6
o Lens Mount Converter (C-mount Adaptor)	WV-AD20

MAJOR OPERATING CONTROLS AND THEIR FUNCTIONS.









1 Camera Mounting Screw Hole
These holes are one each on the top and bottom covers and are used to mount the camera onto a mounting bracket or tripod, and is threaded (1/4" - 20).

2 Power Indicator
This lamp indicates that the camera is in operating condition.

3 Lens (Option)
CAUTION : Use an optional Lens Mount Converter (C-mount adaptor) WV-AD20 to prevent damage of the inner glass and have proper flange-back length when an optional C-mount lens is used.

4 AGC ON/OFF Switch (AGC, ON/OFF)
This switch is used to select the gain of the video amplifier as follows;

ON : When the lens iris is fully opened at low light shooting, a clear picture is obtained by automatic increase of the gain.

OFF : A natural and low-noise picture is obtained at low light shooting.

5 Auto Iris Level Control (AUTO IRIS LEVEL, L(Low)/H(High)
This control adjusts the control level of the auto iris control when the Lens Selection Switch (6) is set to the DC position and the auto iris lens which requires the DC control voltage such as WV-LA12B2 etc., is mounted on the camera.

Note : When the Lens Selection Switch (6) is set to VIDEO position, the auto iris control level should be adjusted by the lens. Adjust this control while setting the AGC ON/OFF Switch (4) to OFF position.

6 Lens Selection Switch (AUTO IRIS, DC/VIDEO)
This switch is used to select the supplied auto iris control signal to the lens from the Auto Iris Lens Connector (7).

DC : Choose this position when the auto iris control lens requiring DC control signal such as WV-LA4.5, WV-LA18, WV-LA36, WV-LA6B2, WV-LA12B2 etc., is mounted on the camera.

VIDEO : Choose this position when the auto iris control lens requiring video signal such as WV-LA8B, WV-LA16B, WV-LA25B, WV-LA50B etc., is mounted on the camera together with optional Lens Mount Converter (C-mount adaptor) WV-AD20.

7 Lens Connector (4 pin)
Use to connect the lens for the automatic iris control.

8 Flange-back Adjusting Ring
Used to adjust the backfocus or picture focus by rotating this ring.

9 Video Output Terminal
Use a coaxial cable with BNC connector. The cable is connected to the CAMERA INPUT connector on the video monitor WV-BM90 or Camera Drive Unit WV-PS10A, WV-PS104 and receives the DC power and vertical drive pulses for the camera from the video monitor WV-BM90 or Camera Drive Unit WV-PS10A, WV-PS104, and also sends the video informations to the video monitor or Camera Drive Unit.

CONNECTIONS

Cautions :
1. Keep the Power Switch of the monitor, optional Camera Extension Unit and optional Remote Control Unit in the OFF position during connection.
   If the power of these units are ON during connection, the camera will not function due to the protection circuit for misconnection.
2. Connect only the specified monitor WV-BM90 or Camera Drive Unit WV-PS10A, WV-PS104 or Camera Extension Unit WV-83.

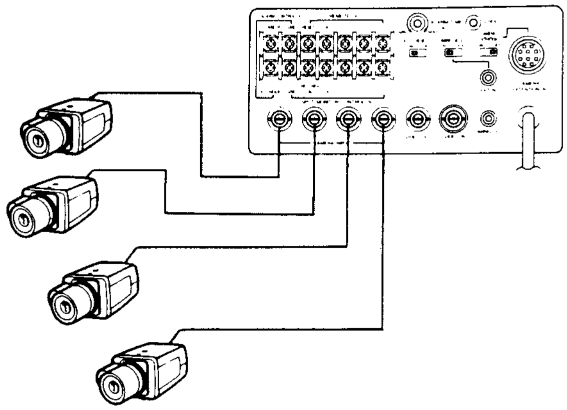
o BASIC SYSTEM

o Connect the single coaxial cables between the cameras and monitor (CAMERA INPUT). The approx. maximum cable length is as;

Coaxial Cable Type	Maximum Cable Length	DC R/1000 ft. of Inner Conductor
RG-59/U	270 m	Less than 30 ohms
RG-6/U	670 m	Less than 12 ohms

The maximum DC resistance between the camera and monitor is 27 ohms.

- **Connection Diagram**



LENSES

1. Selection of Lens

It is recommended to use the following Auto Iris Control Lens.

Specifications \ Models		WV-LA2.8 (Wide Angle)	WV-LA4.5 (Wide Angle)	WV-LA6B2 (Wide Angle)	WV-LA12B2 (Standard)	WV-LA18 (Telephoto)	WV-LA36 (Telephoto)	WV-LZ81/6 (Motorized Zoom)
Image Size		1/2" (6.4 (H) x 4.8 (V) mm)						
Focal Length		2.8 mm	4.5 mm	6 mm	12 mm	18 mm	36 mm	8.5 - 51 mm (6X)
Maximum Aperture Ratio		1 : 1.4	1 : 1.4	1 : 1.4	1 : 1.4	1 : 1.4	1 : 1.8	1 : 1.2 (Wide) 1 : 1.3 (Tele)
Angular Field of View	H	107°17'	70°6'	56°47'	30°26'	20°36'	10°13'	41°56' (Wide) 7°14' (Tele)
	V	88°4'	55°41'	43°31'	22°49'	15°22'	7°39'	31°19' (Wide) 5°28' (Tele)
Focusing Range		Adjusted by Camera	0.3 (m) - ∞	Adjusted by Camera		0.27 (m) - ∞	1 (m) - ∞	1 (m) - ∞
Mount		Special C-mount (CS mount, 1" - 32UN)						
Optional Filter Size		None	ϕ 37.5 mm P = 0.5	None	None	ϕ 37.5 mm P = 0.5	ϕ 37.5 mm P = 0.5	ϕ 49 mm P = 0.75
Dimensions		ϕ 43x34mm	ϕ43x41mm	ϕ43x36mm	ϕ43x36mm	ϕ43x41mm	ϕ43x41mm	86(W)x62(H)x99(D)
Weight		65 g	80 g	50 g	40 g	70 g	80 g	420 g

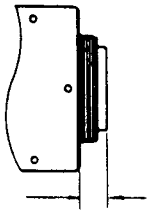
When a manual iris control lens is to be used with, the following lenses are recommended. In this case, the lighting condition should not be varied.

Specifications \ Models		WV-LM4.5 (Wide Angle)	WV-LM6B2 (Wide Angle)	WV-LM12B2 (Standard)
Image Size		1/2" (6.4 (H) x 4.8 (V) mm)		
Focal Length		4.5 mm	6 mm	12 mm
Maximum Aperture Ratio		1 : 1.4	1 : 1.4	1 : 1.4
Angular Field of View	H	70°6'	56°47'	30°26'
	V	55°41'	43°31'	22°49'
Focusing Range		Adjusted by Camera		
Mount		Special C-mount (CS mount, 1" - 32UN)		
Optional Filter Size		ϕ 37.5 mm, P = 0.5	None	None
Dimensions		ϕ 43 x 41 mm	ϕ 43 x 39 mm	ϕ 43 x 39 mm
Weight		100 g	45 g	35 g

- * Dimensions and weight indicated are approximate.
- * Specifications are subject to change without notice.

When you use the lens other than listed above lens mount should be C-mount of special C-mount (CS mount (1"32UN)) and lens weight should be less than 300g. If not, both the lens and camera should be secured.

The protrusion of the rear of the lens should be as shown below.



C-mount : Less than 11.5 mm
CS mount : Less than 7.2 mm

CAUTION:

To use the C-mount lens, the Lens Mount Convertor (C-mount adaptor) WV-AD20 should be used with the camera.

CIRCUIT DESCRIPTION

1. Principle of Black and White CCD Camera

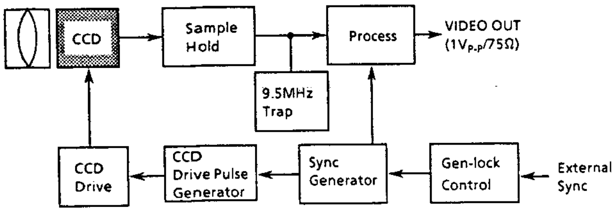


Fig. 1-1 Block Diagram of WV-BL90 Series

The incoming light which passes through the lens reaches the surface of the CCD (Charge Coupled Device) image sensor. The CCD image sensor produces the output signal whose signal level corresponds to incoming light intensity. The output signal is converted into video signal by sample hold circuit. This signal is sent to signal processing circuit where their gamma characteristics is corrected, signal level is set and sync signal is mixed for forming composite video signal.

The sync generator generates necessary pulses for producing the composite video signal and sends them to the CCD drive pulse generator circuit and signal processing circuit.

The CCD drive pulse generator generates H. and V. transfer pulses which are synchronized with the H. and V. drive pulses and sends them to the CCD image sensor through CCD drive circuit for driving sensor.

The gen-lock control circuit receives external vertical pulse and generates clock pulse to be supplied to sync generator circuit for synchronizing the horizontal (H.) and vertical (V.) sync signal.

2. Sensor Board

This board receives the pulses from Drive board and sends these pulses to CCD image sensor IC1 in order to take out the CCD output signal.

The CCD output signal obtained at pin 3 of IC1 is fed through buffer Q1 to the Process board to convert it into the video signal.

- **CCD Image Sensor**

The CCD image sensor used in camera is interline transfer CCD sensor.

The CCD image sensor has 335,237 picture elements (horizontal 577 × vertical 581).

Its image size is 6.58mm (H) × 4.88mm (V) so that 1/2-inch optics and lens can be used.

The CCD image sensor is mounted on dual in line package with 20 pins and has a optical window in front of the cell as shown in Fig 2-1.

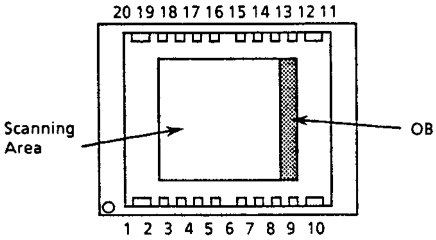


Fig. 2-1 Appearance of CCD Image Sensor

Items	Value	Unit
Chip Size	14.4 (V) × 17.4 (H) (Excluding Base)	mm^2
Cell Size	11.4 (H) × 8.4 (V)	μm^2
Image Size	6.58 (H) × 4.88 (V)	mm^2
Number of Elements	577 (H) × 581 (V) Signal elements	PCS
	603 (H) × 585 (V) Total elements (Including OB)	PCS

Table 1 Specification of CCD Image Sensor

The pin identification of CCD image sensor is as follows.

Pin No	Name	Description
1	OD1	Output Drain1
2	OD2	Output Drain2
3	OS	Output Transistor Source
4	SS1	Substrate 1
5	RD	Reset Drain
6	RS	Reset Gate
7	øH1B	H Transfer Pulse
8	SS2	Substrate 2
9	øH2	H Transfer Pulse 2
10	øH1A	H Transfer Pulse 1
11	IS	Input Source
12	IG	Input Gate
13	TP	Test Terminal
14	øV1	V Transfer Pulse 1
15	øV2	V Transfer Pulse 2
16	SS3	Substrate 3
17	øV3	V Transfer Pulse 3
18	øV4	V Transfer Pulse 4
19	OG	Output Gate
20	OFD	Overflow Drain

- **Constitution and Outline of Transfer of CCD Image Sensor**

CCD image sensor is made up of a simple MOS structure and consists of ;

(1) Photo diode(PD) ..	Generates charge packets corresponding to the incoming light intensity.
(2) V-CCD	Accumulates the charge packets from PD and transfers them in the vertical direction.
(3) H-CCD	Transfers charge packets in the horizontal direction on the output.
(4) Output Section ...	Outputs the signal transferred from the H-CCD sequentially.

The block diagram of CCD image sensor is show below.
Each pixel corresponds to one photo diode.

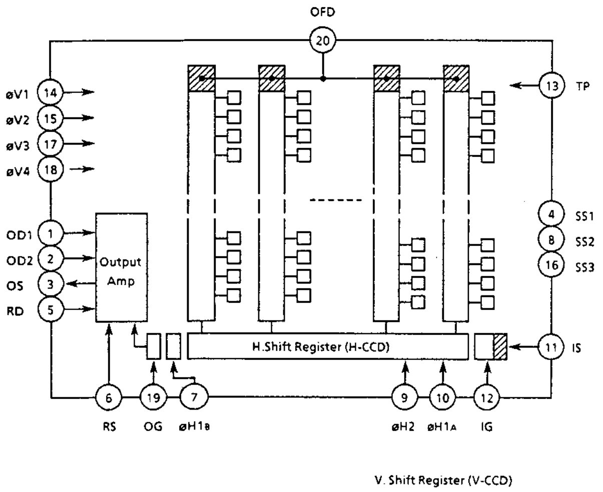

OFD
20
øV1 14
øV2 15
øV3 17
øV4 18
OD1 1
OD2 2
OS 3
RD 5
Output Amp
H.Shift Register (H-CCD)
13 TP
4 SS1
8 SS2
16 SS3
11 IS
6 RS
19 OG
7 øH1B
9 øH2
10 øH1A
12 IG
V. Shift Register (V-CCD)

Fig2-2 Block Diagram of CCD Image Sensor

- **Interline Transfer System**

When the incoming light reaches the photo diode, the signal-charges are accumulated according to the intensity of light. Accumulated charge packets on the independent sensor (photo diode) are transferred to the vertical shift register (V-CCD) all at once in every vertical blanking period. They are then shifted one-step down to the horizontal shift registor (H-CCD) in every horizontal blanking period. The charge packets in H-CCD are transferred to the output amplifier by turns, and taken out as the output signal.

3. Process Board

3-1 Signal Processing Circuit

This circuit receives the modulated CCD output signal and generates video signal.

- **Sample Hold Circuit**

The modulated CCD output signal is supplied through pin 2 to clamp circuit in IC1 in the Process sub board where the modulated CCD output signal is clamped by specified DC voltage. The clamped signal is then sent to the sample hold circuit which eliminates reset pulse and noise component on the CCD output signal and detects prevideo signal. This signal is supplied to amplifier Q19/Q20 and amplified. The amplified prevideo signal is fed to 7.36 MHz low pass filter CF1 which removes horizontal transfer pulse component (10.8 MHz) from prevideo signal. This signal is fed through inverter Q7 to optical black (OB) clamp circuit in IC3.

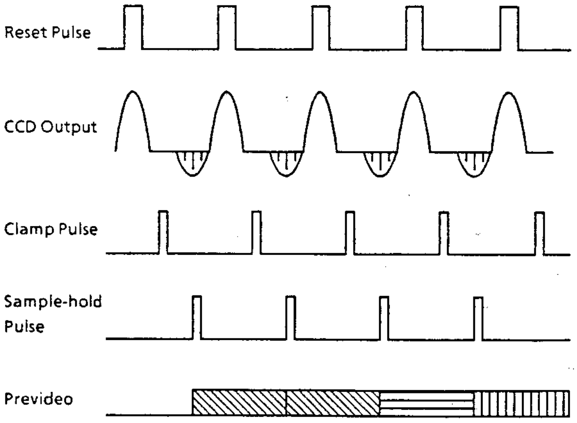

Reset Pulse
CCD Output
Clamp Pulse
Sample-hold Pulse
Prevideo

Fig. 3-1 Waveform of Sample Hold

- **Optical Black Clamp Circuit**

Prevideo signal from inverter Q7 is fed through pin 29 to optical black (OB) clamp circuit in IC3. A optical black for blocking the incoming light is built at the end of horizontal scanning period on the surface of CCD image sensor.

When the CCD reads out optical black portion, the dark current of the CCD is detected and this signal portion is clamped to a DC potential. However this dark current is fluctuated due to variation of CCD temperature. So that thermo-detect resistor is placed beside the CCD for producing compensation current at the Mother board. The compensation current is supplied to pedestal clamp circuit. Therefore black level variation due to change of dark current is eliminated.

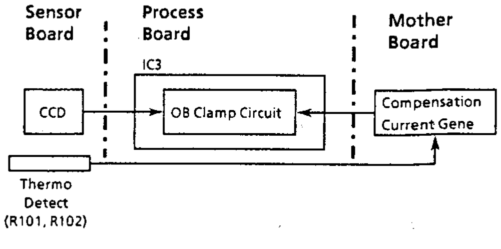

Sensor Board
Process Board
Mother Board
IC3
CCD
OB Clamp Circuit
Compensation Current Gene
Thermo Detect (R101, R102)

Fig 3-2 OB Clamp Circuit

The clamped video signal is mixed with the wide horizontal drive (WHD) pulse which is separated in IC3 from the mixed signal of clamp pulse-1 (CP1) and WHD pulse and the noise during the blanking period is removed. This signal is supplied to gain control circuit and automatic light control(ALC) circuit.

- **Gain Control Circuit**

When AGC ON/OFF switch on the rear of camera is set to OFF position, low(L) level is obtained at pin 1 of CN1 and the L level is converted to high(H) level by inverter IC1. The H level is then supplied to pin 7 of IC2 for connecting pins 6 and 5 of analog switch. Therefore gain control DC bias set by VR2(GAIN SET) is supplied to gain control circuit in IC3 through pin 28 for setting the amplitude of gain control circuit to standard state.

When AGC ON/OFF switch is set to ON position, H level is obtained at pin 1 of CN1 and the H level is supplied to pin 3 of IC2. As a result, pins 1 and 2 of IC2 are conducted and gain control DC bias generated by AGC detector circuit in IC3 and VR3 (AGC SET) is supplied through pin 28 of IC3 to gain control circuit in IC3 for controlling the amplitude of gain control circuit.

The gain controlled video signal is then fed through pin 27 of IC3 to 10.8 MHz trap CF2 where the remaining switching noise on the video signal is eliminated. This signal is fed through buffer Q8 and pin 24 of IC3 to clamp circuit where the video signal is clamped to specified clamp DC level. The clamped video signal is supplied to gamma correction circuit in IC3.

- **Gamma Correction Circuit**

The gamma(γ) correction circuit corrects the non-linear photoelectric conversion characteristic of cathode ray tube (CRT) and reproduces a linear picture of high fidelity on the monitor.

In order for a televised picture to have the same contrast gradation as the original scene, the gamma of the system including CCD image sensor, signal processing inside camera and monitor must be equal to 1.0.

The gamma characteristic of CCD image sensor is approximately 1.0 and the gamma characteristic of the monitor is approximately 2.2, so that the gamma characteristic of the gamma correction circuit should be approximately 0.45 which makes the total gamma to be approximately 1.0.

The gamma corrected video signal is supplied to AGC detection circuit and level control circuit respectively.

- **AGC Detection Circuit**

The video signal from gamma correction circuit is peak-rectified in the AGC detect circuit and converted into DC voltage corresponding to the video signal level that is, incoming light intensity. The DC voltage obtained at pin 4 of IC3 is supplied through pin 5 to amplifier (AGC OP AMP) in IC3 where it is compared with the reference DC voltage.

The error DC voltage obtained at pin 6 of IC3 is fed back through IC2 to gain control circuit in IC3 to control the amplitude.

When the camera is used in the normally illuminated scene, the amplitude of gain control circuit does not change. However, when the camera is aimed at the weakly illuminated scene, lens iris is fully opened and the video signal level is decreased. The decreased video signal level is detected by the AGC detection circuit and the amplitude to relatively low illumination is controlled.

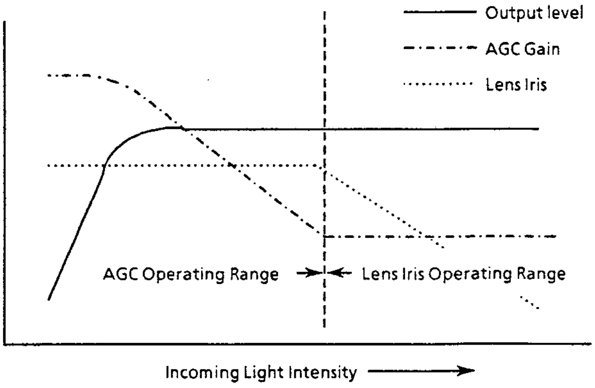


Fig. 3-4 AGC Operation

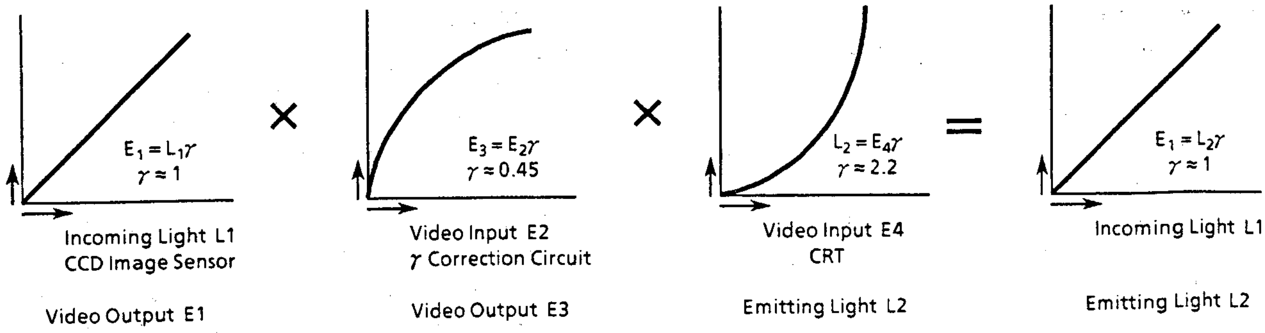


Fig. 3-3 Gamma Correction

- **Horizontal Aperture Signal Generator Circuit**

The video signal from gamma correction circuit obtained at pin 22 of IC3 is fed through VR4(Y.LEVEL) and buffer Q9 to horizontal aperture signal generator circuit.

When the camera is aimed at object(A) for example, the signal(B) obtained at buffer Q9 and passed through pin 20 of IC3, signal(C) delayed 110ns by delay line CF4 and amplified by aperture amplifier (AP AMP) in IC3 and signal(D) which results from the delayed video signal being reflected back through CF4 and the delayed again (220ns) appear at the output of the H. aperture generator circuit where they are mixed in fixed proportions to make up the H. aperture signal(E).

The H. aperture signal obtained in this way and fed through pin 17 of IC3, buffer Q14 and pin 16 of IC3 is mixed with the video signal sent through buffer Q11 and H. aperture-mixed video signal(F) is made.

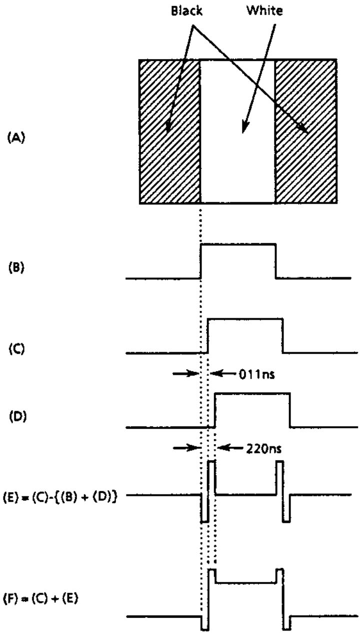


Fig. 3-5 Horizontal Aperture signal.

- **Video Signal Processing Circuit**

The video signal(A) from Y/Aperture mix circuit is forwarded to clamp circuit where the blanking level of the mixed signal is clamped to specified DC level.

The clamped video signal is then sent to the BL mix, high clip, low clip circuit where it is mixed with the blanking pulse(B). The high clip circuit clips the high level signal and the low clip circuit clips the low level portion of mixed signal(C) for setting the pedestal level(D).

The mixed signal undergoes the high and low clip is mixed with the sync signal(E) through pin 12 of IC3 for forming a composite video signal(F). The composite video signal obtained at pin 13 of IC3 is supplied through pin 8 of CN2 to video output circuit on the DC/DC board.

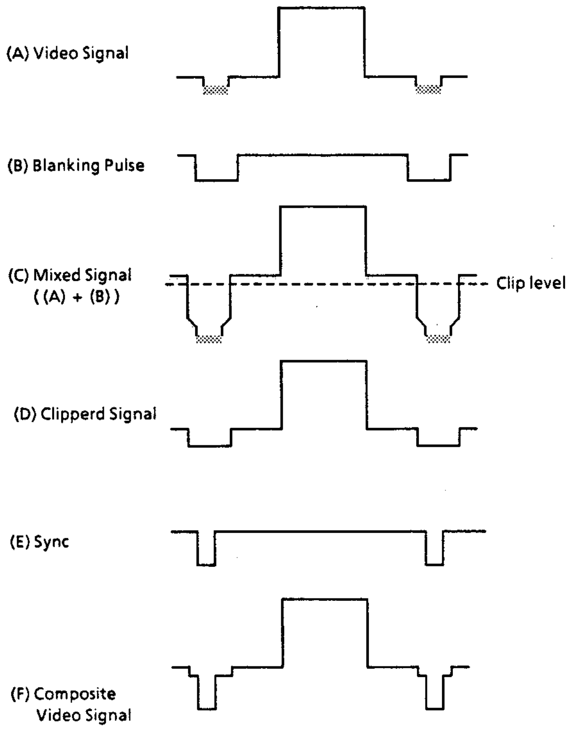


Fig. 3-6 Video Signal

3-2 ALC Circuit

- **ALC Video Output Circuit**

The prevideo signal passes CF1 is fed through buffer Q1-2 to clamp Q3 where the blanking periods of prevideo signal are clamped to specified DC level by clamp pulse 1(CP1) fed from pin 20 of CN2. The clamped prevideo signal is then applied to sync mix Q2 where prevideo signal and composite sync signal(SYNC) fed from pin 25 of CN2 are mixed to produce composite video signal. This signal is amplified by Q1-1 and supplied to Switch board. When lens selection switch SW2 on the Switch Board is set to video position, prevideo signal made by this circuit is sent out from lens connector.

- **ALC DC Output Circuit**

The prevideo signal mixed with the WHD in IC3 sent through ALC amplifier, ALC gamma correction and DC control circuits to ALC detection circuit in IC3 where the video signal is converted into DC voltage corresponding to the incoming light intensity. This detected DC voltage obtained at pin 38 of IC3 and VR5 (ALC1) is fed through pin 41 of IC3 to error amplifier (ALC OP1 AMP) in IC3 where the DC voltage is compared with reference DC voltage and the error DC voltage obtained at pin 40 of IC3 is supplied through buffer Q13 and Q12 to Switch board. When lens selection switch SW2 on the Switch board is set to DC position, this error DC voltage is supplied to lens iris drive coil of the ALC lens to directly control the lens aperture.

3-3 Gen-lock Control Circuit

This circuit generates reference 17.7MHz clock signal which is sent to sync generator in the Drive board for generating the sync and transfer pulses.

This circuit also receives a vertical pulse from the Camera Drive Unit or specified video monitor and compares it in phase with vertical pulse generated in the sync generator.

The resultant in comparison controls generating reference 17.7MHz clock signal and the clock signal is then fed to the sync generator. The vertical reset pulse is generated by the gen-lock control IC and it is fed to the sync generator to generate vertical pulses synchronized with the external vertical pulse.

The pin identification of gen-lock control IC5 (YWPD65012GB) is as follows.

Pin No.	Name	In/Out	Description
1	VR	Out	Not Used
2	HV	Out	Not Used
3	EXH	In	Not Used
4	I1	In	Mode Select (H:LL, L:INT/EXT)
5	MI2	—	Not Used
6	MI3	—	Not Used
7	MI4	—	Not Used
8	EXV	In	External Vertical Sync signal
9	TSTI	—	Not Used
10	VDO	—	Not Used
11	DPC	In/Out	VD Phase Control
12	TCK1	—	Not Used
13	TCK2	—	Not Used
14	VCOI	—	Not Used
15	VCOO	—	Not Used
16	CLKO	—	Not Used
17	GND	—	Ground
18	EVS	In	M.M Select(H:INT, L:EXT)
19	PN1	In	SC Counter Select
20	PN2	In	System Mode Select (H:EIA, L:CCIR)
21	PCO1	Out	Phase Comp. Out
22	PCO2	Out	Phase Comp. Out
23	CLRP	—	Not Used
24	EI	Out	EXT/INT Mode Select (H:EXT, L:INT)
25	HPC	In/Out	Horizontal Phase Control
26	S1	—	Not Used
27	SO	—	Not Used
28	D1	—	Not Used
29	DO	—	Not Used
30	OS	—	Not Used
31	OD	—	Not Used
32	IV2	Out	INT 1/2V Pulse
33	VLP	In	Not Used
34	TSTM	—	Not Used
35	VLO	—	Not Used
36	LPC	—	Not Used
37	ENA	—	Not Used
38	CLR1	—	Not Used
39	VDD	In	+5V DC Power
40	VSRS	—	Not Used
41	SCN	—	Not Used
42	SC	In	Subcarrier
43	NWHD	—	Not Used
44	WHD	In	Wide Horizontal Drive pulse

The H level is supplied to pin 4 of IC5 for enabling this gen-lock control circuit to vertical pulse lock mode, and high level at pin 24 of IC5 is applied to pins 1, 12 and 13 of IC16.

In this stage, the vertical pulse made by dividing the wide horizontal drive (W HD) pulse at pin 44 of IC5 is compared in phase with the vertical pulse supplied to pin 8 of IC5.

The resultant in comparison is then sent from pins 21 and 22 through buffer Q18 to voltage controlled oscillator (VCO) consisting of D1, D2, C49-51, L7 (EXT VCO ADJ) to control oscillating frequency. The oscillating frequency is sent to sync generator in the Drive board to generate the WHD pulse. In this way, the phase lock loop (PLL) circuit is formed and sync generator generates WHD pulse which is synchronized with the external vertical pulse.

At the same time, the V reset pulse obtained at pin 32 of IC5 is fed via IC6 to sync generator in the Drive board to generate the vertical rate pulses which are synchronized with the external vertical pulse.

4. Drive Board

4-1 Sync/Drive Signal Generator

This circuit consists of IC4 and generates pulses necessary to produce the video signal and to drive the CCD image sensor. The pulses are made from 17MHz clock signal sent to pin 29 of IC4. The externally controlled 17MHz clock signal and V. reset pulse are supplied from Process board to pin 29 and pin 31 of IC4 respectively.

The pin identification of IC4 (YWTC6013U) is as follows.

Pin No.	Name	In/Out	Description
1	HD	Out	Horizontal Drive Pulse
2	PS	In	Phase Comparator Pulse
3	RHD	Out	Horizontal Drive Pulse
4	PDO	Out	Phase Comparator Output
5	VDD	-	+5V DC Power
6	VSS	-	Ground
7	CKI	In	10.875MHz Clock Signal
8	INT	In	Accumulator Select (H : Field / L : Frame)
9	SHT	In	Shutter Mode Select (H : Normal / L : Shutter)
10	RESET	In	Not Used
11	VHP	Out	øH Inhibit Pulse

12	LI	Out	Not Used
13	PBLK	Out	Composite Preblanking Pulse
14	SYNC	Out	Composite Synchronize Pulse
15	CBLK	Out	Composite Blanking Pulse
16	PAP	Out	Not used
17	VDD	-	+ 5V DC Power
18	VSS	-	Ground
19	CP1	Out	OB Clamp Pulse
20	CP2	Out	Signal Clamp Pulse
21	CP3	Out	Not Used
22	PBF	Out	Not Used
23	BF	Out	Not Used
24	BSC	Out	Not Used
25	SC1	Out	4.43MHZ Subcarrier
26	SC2	Out	Not Used
27	TEST	In	Not Used
28	VSS	-	Ground
29	CK4FSC	In	17.7MHz Clock Pulse
30	VD	Out	Not Used
31	VRS	In	Vertical Reset Pulse
32	FI	Out	Not Used
33	CF	Out	Not Used
34	WID	Out	Not Used
35	HP	Out	Not Used
36	FRM	Out	Not Used
37	FV1N	Out	V-CCD Transfer Pulse-1
38	FV2N	Out	V-CCD Transfer Pulse-2
39	VDD	-	+ 5V DC Power
40	FV3N	Out	V-CCD Transfer Pulse-3
41	FV4N	Out	V-CCD Transfer Pulse-4
42	FSAN	Out	V-CCD Readout Pulse-1
43	FSBN	OUT	V-CCD Readout Pulse-2
44	PR	In	Phase Comparator Signal

- **Sync Signal**

The composite blanking pulse (CBL) from pin 15 of IC4 fed through inverter IC5 and clamp pulse-2(CP2) from pin 20 are mixed at cross point of R46 and R47 and then sent to Process board.

The pre-blanking pulse(PBLK) from pin 13 of IC4 and clamp pulse-1(CP1) from pin 19 are mixed at cross point of R51 and R53 and then send it to Process Board. The CP1 is also directly sent to the Process board.

The horizontal drive pulse(HD) from pin 1 of IC4 is fed through pulse drive amplifier Q7 and Q8 to DC/DC board. The WHD pulse is directly fed to the Process board from pin 1 of IC4. The sync signal at pin 14 of IC4 is sent to the Process board.

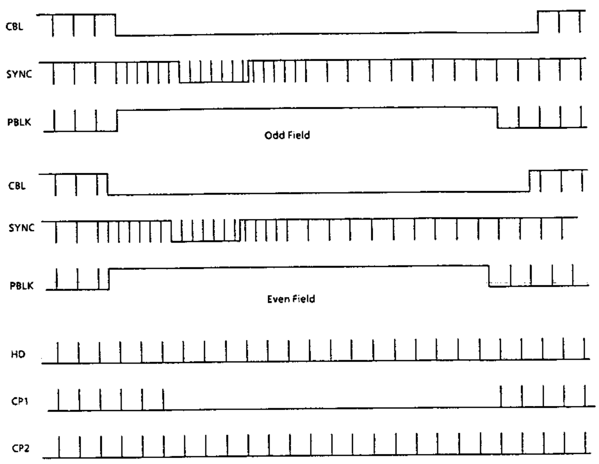


Fig. 4-1 Sync Signal

- **Drive Signal**

The vertical drive timing pulse for CCD image sensor are also generated by IC4 together with 21MHz VCO circuit and IC3. The V. drive timing pulses from pins 37 - 43 of IC4 are sent to øV drive IC1 where the level of V. drive pulse is converted to specified level corresponding to the V. transfer timing of CCD image sensor. These signals are supplied to sensor board to drive the CCD image sensor.

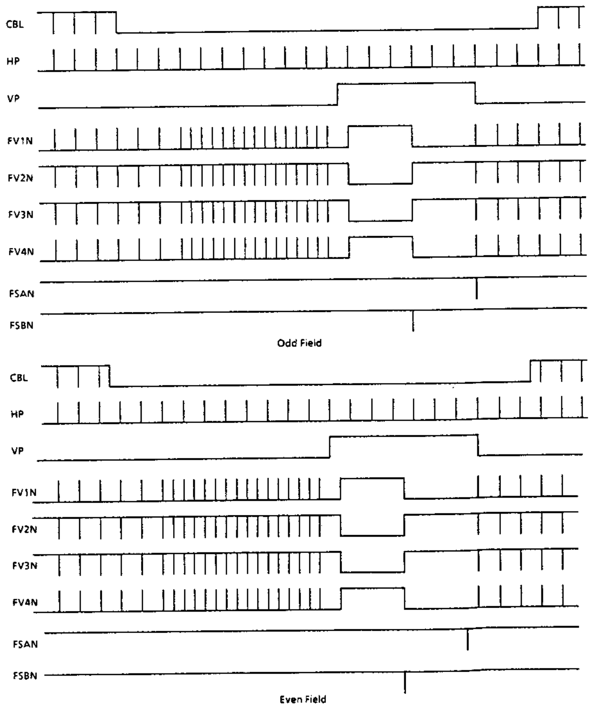


Fig. 4-2 Drive Signal

4-2 21MHz Clock Generator

This circuit generates 21.75MHz clock signal utilizing voltage controlled oscillator(VCO) circuit consisting of D1,D2, R20, R22, R23, C12, C14, C15 and L2(VCO ADJ).

The 21.75MHz clock signal obtained at pin 4 of IC2 is supplied to pin 26 of IC3. In IC3, 21.75MHz clock signal is divided by 1/2 to generate 10.875MHz. The 10.875MHz signal at pin 15 of IC3 is sent to pin 7 of IC4 and divided by 1/232 and approximately 15.625KHz signal is generated. On the other hand, 17MHz clock signal fed to pin 29 of IC4 is divided by 1/1135 times in IC4 and approximately 15.625KHz signal is generated.

The both 15.625KHz signal obtained at pins 44 and 2 of IC4 are compared in phase and phase difference is converted into DC bias and obtained at pin 4 of IC4. This DC bias is fed through low pass filter(LPF) Q6 to 21 MHz VCO circuit for forming phase locked loop(PLL) circuit to synchronize 21MHz signal to reference 17MHz clock signal.

4-3 H. Transfer Pulse Generator

This circuit consists of IC3 and generates H. transfer(øH) pulse to drive CCD image sensor.

The IC3 receives 21.75MHz clock signal at pin 26. It is divided by 1/2 to generate øH1A, øH1B, øH2 and øRS pulses obtained at pins 30, 31, 37 and 36 respectively. These pulses are sent to Sensor board.

4-4 Bias Circuit

This circuit produces various DC bias for CCD image sensor and øV drive.

Approximately 4.0V of output gate(OG) bias voltage set by VR2(VOG ADJ) is supplied to CCD image sensor.

Overflow drain(OFD) bias set by VR1(V_{OFD} ADJ) is supplied through buffer Q9 to CCD image sensor.

Approximately +12V obtained at emitter of Q1 is supplied to pin 16 of øV drive IC1 to set high level (øVH) of vertical transfer pulses..

Approximately -7.0V obtained at emitter of Q2 is supplied to pin 1 of øV drive IC1 for setting low level (øVL) of øV pulses.

The pin identification of IC3 (YWTC6003F) is as follows.

Pin No.	Name	In/Out	Description
1	GRB	In	Not used
2	FRB	Out	Not used
3	G1A	In	Not Used
4	FC1	Out	Not Used
5	VDD	-	+5V DC Power
6	VSS	-	Ground
7	VSS	-	Ground
8	G1B	In	Not used
9	FC2	Out	Not used
10	G2A	In	Not Used
11	FC3	Out	Not Used
12	G2B	In	Not Used
13	FC4	Out	Not Used
14	FC5	Out	Not Used
15	LCK	Out	Clock Pulse
16	VSS	-	Ground
17	VDD	-	+5V DC Power
18	GC	In	+5V DC Power
19	DMC	Out	Not used
20	DMCN	Out	Not Used
21	DMPC	In	Ground
22	VSS	-	Ground
23	VP	In	Ground
24	HP	In	H-CCD Drive Control Pulse
25	CKO	Out	Inverted Clock Pulse
26	CKI	In	Master Clock Signal
27	Vss	-	Ground
28	Vss	-	Ground
29	VDD	-	+5V DC Power
30	H1A	Out	H. Transfer Pulse-1 A
31	H1B	Out	H. Transfer Pulse-1 B
32	VSS	-	Ground
33	RS1	Out	Not used
34	MODE	In	+5V DC Power
35	EN	In	Ground
36	RS2	Out	CCD Reset Gate Pulse
37	H2	Out	H Transfer Pulse-2
38	VSS	-	Ground
39	VDD	-	+5V DC Power
40	BP1	Out	Clamp Pulse
41	BP2	Out	Sample Hold Pulse
42	BP3	Out	Sample Hold Pulse
43	GPA	In	Not Used
44	FRA	Out	Not Used

5. DC/DC Board

5-1 Power Circuit

The W.HD pulse generated in Drive board and obtained at pin 12 of CN1 is amplified by pulse drive Q1 and Q2 for necessary level and supplied to the primary winding of T1.

The boosted/attenuated pulses obtained at the secondary winding of T1 are rectified to generate necessary DC voltage.

- +20V DC generated by rectifying the boosted pulse at T1 with D2 is supplied to the Drive board.
- +6V DC generated by rectifying the attenuated pulse at T1 with D3 is supplied to the Drive board.
- -11V DC generated by rectifying the pulse with D4 is supplied to the Drive board.

5-2 Regulator Circuit

- **+1.8V Regulator**

+1.8V is generated from +5V(1) DC power using IC1(a). The output voltage of IC1(a) is applied to pin 2 of IC1(a) to form a feedback loop for regulating the voltage. The reference voltage is obtained by dividing the +5V(1) DC using R15 and R16.

- **+5V(2) Regulator**

+5V(2) DC is generated from +6V DC power using IC1(b). The +1.8V from IC1 (a) is compared in IC1 (b) with the voltage obtained by dividing +5V with R13 and R14. The error obtained in IC1(b) is applied to base of Q3 to control the base bias of Q3 and regulated +5V is obtained at the collector of Q3.

- **+5.3V Regulator**

+5.3VDC is generated from +9V DC power using IC2(a). The output voltage at pin 1 of IC2(a) is applied through R10 to pin 2 of IC2(a) to form a feedback loop, and thus stabilizing the voltage. This +5.3V DC is applied to pulse drive on the power circuit for increasing the common line of power circuit, and thus +3.7V power appears on the primary circuit of power circuit.
The reference voltage is obtained by dividing the +9V DC using R5-R9.

- **+5V(1) Regulator**

+5V DC is generated by regulating +9V DC using IC2(b). The output voltage obtained at pin 7 of IC2(b) is applied through buffer Q4 to pin 5 of IC2(b) to form a feedback loop, and thus stabilizing the voltage. The reference voltage is obtained by dividing the +9V DC using R6 and R5. The current from +9V DC through primary winding of T1, Q2 and +5.3V line is mixed at Q4 for supplying the large current on the +5V(1) DC power source.

5-2 Video Output Circuit

2Vp-p composite video signal produced at Process board and obtained at pin 7 of CN1 is fed through buffer Q5 to 5.45MHz L.P.F CF1 where the band width of video signal is limited to less than 5.45MHz. This signal is amplified 6dB by amplifier Q6 and fed through buffer Q7 to video output drive circuit consisting of Q8-Q11. The video signal from video output drive circuit is supplied through pin 18 of CN1 to video output terminal of camera.

6. Control Board

6-1 Pedestal Correction Circuit

This circuit produces pedestal correction DC voltage which sets the optical black(OB) level of prevideo signal to fixed potential against the blanking level regardless of the temperature variation of CCD image sensor. IC1 and Q13 produces regulated approximately 6V DC set by VR4(PEDESTAL 2) and is supplied through thermo-detection resistor R101, R102 on the Sensor board to the base (pin 4) of Q12 in the pedestal compensation circuit consisting of Q10 - Q12 and Q14 on the Control board. The pedestal compensation circuit sends the DC voltage corresponding to detected temperature to OB clamp circuit in IC3 on the Process board for setting the pedestal level.
When temperature of CCD image sensor increases for example, pedestal level of prevideo signal also increases. At this time, resistance of thermo-detecting resistor R101 and R102 increases and pedestal control DC level obtained at pin 4 of Q12 is decreases since constant current circuit consisting of Q10 and Q11-1 is connected to thermo-detecting resistance. This DC level is supplied through buffer Q14 to OB clamp circuit in IC3 on the Process board for setting the pedestal level.
When temperature of CCD image sensor decreases, reverse operation takes place. In this way pedestal level is kept constant.
This circuit functions when the temperature of CCD increases more than specified temperature and VR1(PEDESTAL 1) sets the threshold of the circuit.

6-2 Misconnection Protector Circuit

When the specified Video monitor or Camera Drive Unit connected to WV-BL90 is turned ON, approx. 4V is momentarily supplied from the specified video monitor to astable multivibrator Q1~Q3 through the coaxial cable, and the multivibrator generates a pulse whose frequency is approx 40KHz.
This pulse appears on the Video/+12V line since the line has a high impedance. When the misconnection protection circuit in the specified video monitor or Camera Drive Unit detects the pulse generated by the multivibrator, the power circuit in the monitor or Camera Drive Unit provides the DC power to the camera WV-BL90 (approx. +13V DC measured at camera side) constantly through the coaxial cable.
When the potential at +9V line exceeds +4V, D1 and Q4 are turned ON and Q3 is turned OFF to stop the oscillation of multivibrator, and no pulse appears on the Video/+12V line.

6-3 Impedance Converter and +9V DC Regulator Circuit

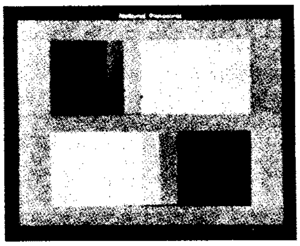
Approx. +13V DC supplied from the specified video monitor is fed to +9V regulator circuit consisting of Q7, Q8, Q9, Q101 and Q102 through impedance converter Q5, which converts the impedance of Video/+12V line from high to low.
The Q7 amplifies the error between the 6.2V zener (D2) reference and its base potential and forwards it to Q102 and Q9. If the emitter potential of Q102 changes, the base potential of Q7 also changes and the changed voltage appears at its collector. This change controls the collector current of Q102 in the direction which is same as the voltage change at emitter of Q102.
In this way, the voltage at emitter of Q102 is kept constant.

ADJUSTMENT

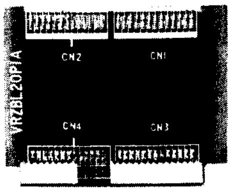
1.Test Equipment Required

The following equipment is required for adjustment of WV-BL90.

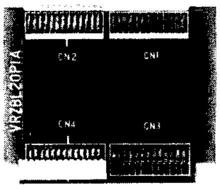
- Oscilloscope (50MHz band width, dual trace, delayed with three probes)
- Digital Voltmeter
- Underscanned video monitor
- Sync Signal generator
- Lens : Automatic iris control lens such as WV-LA12 or Manual iris lens (F1.4 16mm)
- Lighting (140 footcandles (1400 lux) 3200°K)
- Light meter
- Logarithmic gray scale chart (Part No. YWV2310RB99)



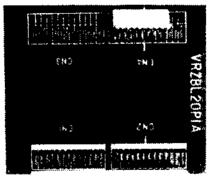
- Extension boards


VRZBL20PIA
CN2
CN1
CN4
CN3

YWVOEA0059AN


VRZBL20PIA
CN2
CN1
CN4
CN3

YWVOEA0060AN


VRZBL20PIA

YWVOEA0067AN

2. Disassembling Procedure for Adjustment

- Turn OFF the power of the Video Monitor WV-BM90.
- Remove a screw holding rear cover and remove the rear cover by opening it from upper side while depressing the rear portion of upper cover.(Fig.2-1)

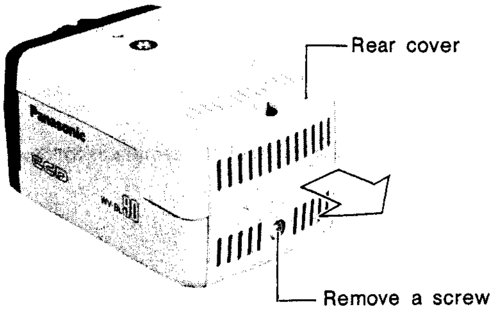

Rear cover
Remove a screw

Fig. 2-1

- Remove a screw holding the upper cover and remove the upper cover by pulling it backward, while lift the front portion of cover, and remove a screw holding bottom cover and remove bottom cover by same procedure as upper cover removal.(Fig.2-2)

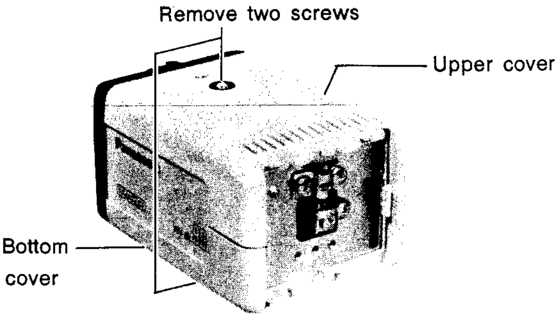

Remove two screws
Upper cover
Bottom cover

Fig. 2-2

- Remove three screws holding the shield cover and remove the shield cover. (Fig. 2-3)
- Remove four screws holding PCB holder and remove the PCB holder. (Fig.2-3)

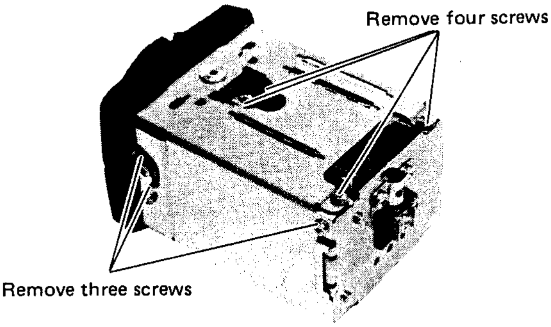

Remove four screws
Remove three screws

Fig. 2-3

- Remove respective PCB assembly by pulling it upward and replace the PCB assembly using the correspond extension board.(Fig.2-4)

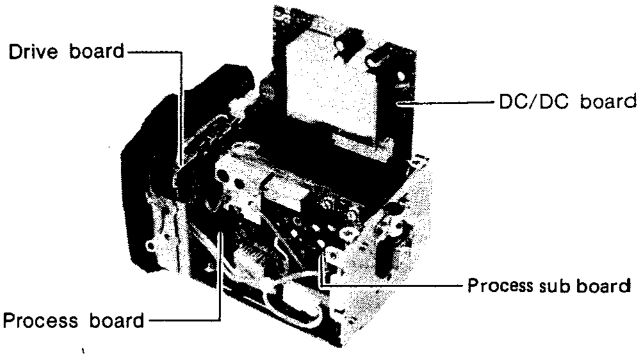

Drive board
DC/DC board
Process sub board
Process board

Fig.2-4

3. CCD Image Sensor Replacement

- Disassemble the camera as previous described in section 2.
- Disconnect E1 on the Process sub board, CN6 on the Mother board and CN3 on the Drive board.

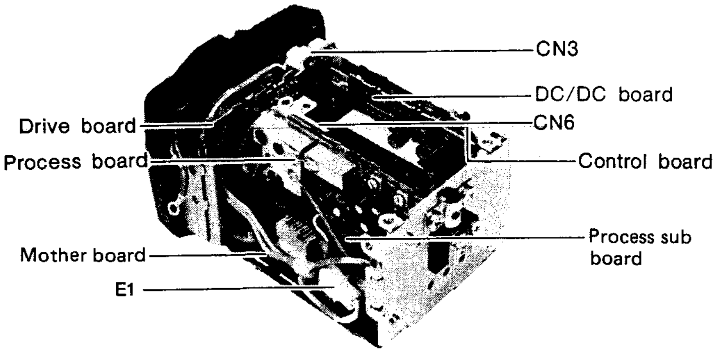

CN3
DC/DC board
Drive board
CN6
Process board
Control board
Process sub board
Mother board
E1

Fig. 3-1

- Remove a screw holding front chassis and remove the front chassis together with Drive board by pulling it forward after sliding aside the front chassis for unlock.

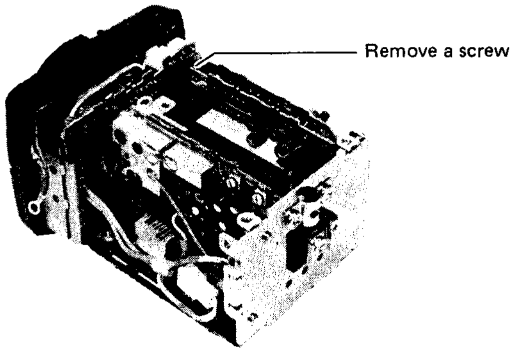

Remove a screw

Fig. 3-2

- Disconnect CN1 on the Drive board and remove the Drive board.

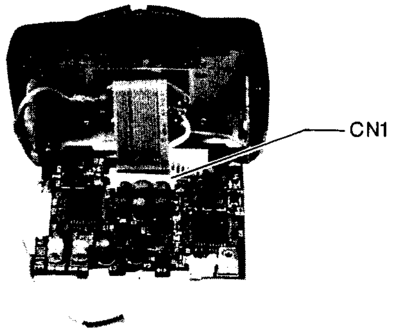


Fig. 3-3

- Remove two screws holding CCD board and remove the CCD board.
- Unsolder the CCD pins and remove the CCD image sensor from CCD board.

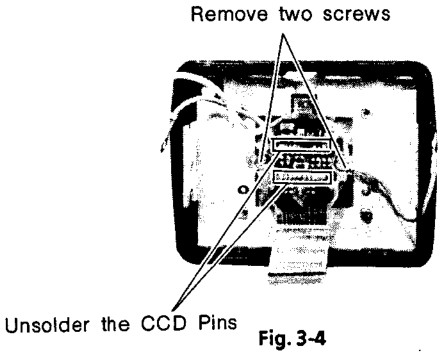

Remove two screws
Unsolder the CCD Pins

Fig. 3-4

- Reinstall the new CCD image Sensor to the CCD board.
- After replacing the CCD image Sensor, reinstall the camera in reverse precedure of disassembling.

4. Connection and Setting Up for Adjustment

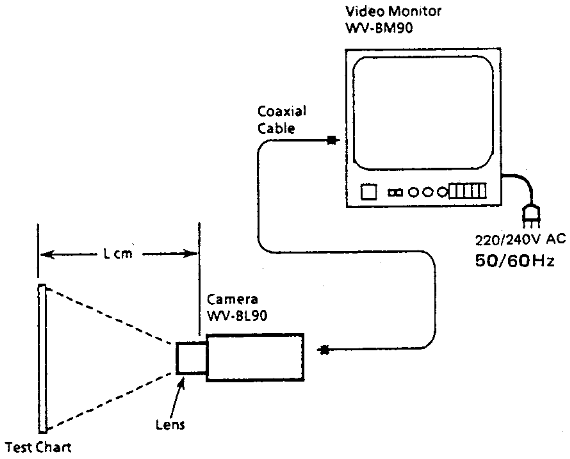

Video Monitor
WV-BM90
Coaxial Cable
220/240V AC
50/60Hz
L cm
Camera
WV-BL90
Lens
Test Chart

Fig. 4-1

Connection

- Connect the coaxial cable between video output connector and underscanned black and white video monitor.
- Terminate video input of the monitor with 75 ohms.
- Position the logarithmic grayscale chart in front of camera as shown in Fig. 4-1.

Setup

- Set respective switches on the camera as follows.

AGC ON/OFF Switch	ON position
Lens Selection Switch	DC position

5. Adjustment Procedure

- Refer to page 20 for the position of test points and adjusting controls.

(1) +9V adjustment

Test point :	**TP10(9V)**	**Process board**
Adjust :	**VR1 (+9V ADJ)**	**Control board**

- Connect the digital voltmeter to TP10 on the Process board.
- Adjust VR1 (+9V ADJ) for 9V ± 0.05V.

(2) VOG adjustment

Test point :	**TP2 (VOG)**	**Drive board**
Adjust :	**VR2 (VOG ADJ)**	**Drive board**

- Connect the digital voltmeter to TP2 on the Drive board.
- Adjust VR2 (VOG ADJ) for 4.0V ± 0.1V.

(3) IEXT VCO adjustment

Test point :	**TP9 (PLL VCO)**	**Process board**
Adjust :	**L7(EXT VCO ADJ)**	**Process board**

- Connect the digital voltmeter to TP9 on the Process board.
- Adjust L7 for 2.2V ± 0.1V.

(4) INT 21MHz adjustment

Test point :	**TP3 (VCO)**	**Drive board**
Adjust :	**L2(VCO ADJ)**	**Drive board**

- Connect the digital voltmeter to TP3 on the Drive board.
- Adjust L2 for 2.2V ± 0.1V.

(5) Flangeback adjustment

Adjust : **Flangeback adjusting ring**

- Aim the camera at dark object further than 10m.
- Set the lens focus to infinity (∞) position.
- Adjust flangeback adjusting ring for best focus.
- Set between camera and object to 0.6m and lens focus ring to 0.6m position.
- Confirm that picture is in-focus. If not, re-adjust flangeback adjusting ring for best focus.
- Repeat above procedure until the focus tracks throughout the lens focus.

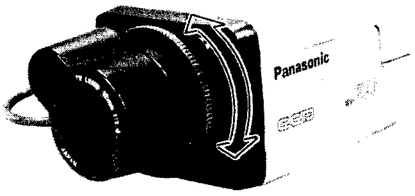


Fig. 5-1

(6) VOFD adjustment

Test point :	**S. IN Terminal**	**Process sub board**
Adjust :	**VR1 (VOFD ADJ)**	**Drive board**

- Aim the camera at white chart or white paper.
- Set the fild/flam switch on the control board to fild position.
- Set VR2 (ALC ADJ) on the control board to fully clockwise position for fully opening the lens iris when automatic iris lens is used or set the lens iris to F1.4 position when manual iris lens is used.
- Connect the oscilloscope to S. IN terminal on the Process sub board.
- Set the oscilloscope at H.rate.
- Adjust VR1 (VOFD ADJ) on the Drive board so that the white signal level becomes 0.8V ± 0.02V. (Fig. 5-2)
- Reset VR2 (ALC ADJ) to its mechanical center position.

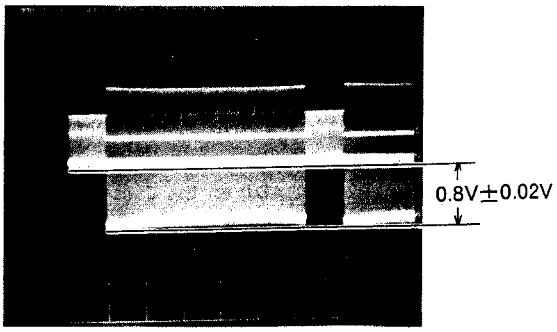


Fig. 5-2

(7) Pedestal adjustment

Test points :	**Video out**	**Rear panel**
	TP1 (OB1)	**Control board**
	TP2 (OB2)	**Control board**
Adjusts :	**VR3 (PEDESTAL1)**	**Control board**
	VR4 (PEDESTAL2)	**Control board**

- Cap on the lens.
- AGC ON/OFF switch to ON position.
- Connect the oscilloscope to video output terminal on the Rear panel.

- Trigger the oscilloscope at H rate.
- Adjust VR4 (PEDESTAL 2) on the Control board so that the pedestal lelvel is 55mV ± 10mV. (Fig. 5-3)

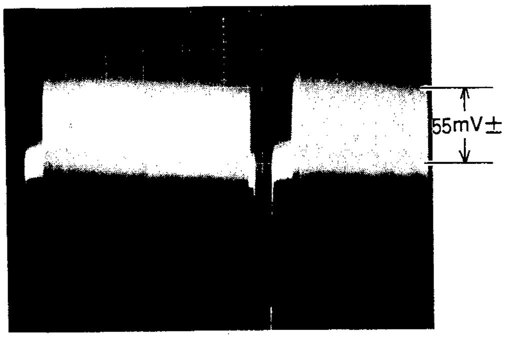


Fig. 5-3.

- AGC ON/OFF switch to OFF position.
- Confirm that level is 50mV ± 30mV.
- Connect the (+) probe of digital voltmeter to TP1 and (−) probe to TP2 on the Mother board.
- Adjust VR3 (PEDESTAL 1) so that the voltage between TP1 and TP2 is 200mV ± 10mV.
- Repeat adjusting VR3 and VR4 so that the pedestal level is 55mV ± 10mV and voltage between TP1 and TP2 is 200mV ± 10mV.

(8) ALC adjustment

Test pint :	**TP2 (PREVIDEO)**	**Process board**
Adjust :	**VR5 (ALC 1)**	**Process board**

- Aim the camera at logarithmic gray scale chart.
- Connect the oscilloscope to TP2 on the Process board.
- Trigger the oscilloscope at H rate.
- Confirm that the VR2 (ALC ADJ) on the Control board is set to its mechanical center position.
- Adjust VR5 (ALC 1) so that the signal level at TP2 becomes 0.25V ± 0.01V. (Fig.5-4)

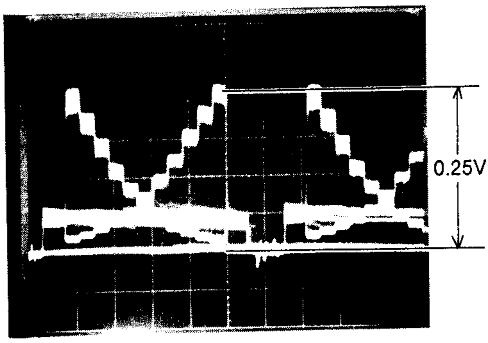


Fig. 5-4

(9) Gain adjustment

Test point :	**TP3 (Y)**	**Process board**
Adjusts :	**VR3 (AGC SET)**	**Process board**
	VR2 (GAIN SET)	**Process board**

- Aim the camera at logarithmic gray scale chart.
- Connect the oscilloscope to TP3 on the Process board.
- Trigger the oscilloscope at H rate.
- Set the AGC ON/OFF switch to ON position.
- Adjust VR3 (AGC SET) so that the signal level becomes 0.8V ± 0.02V. (Fig. 5-5)
- Set the AGC ON/OFF switch to OFF position.
- Adjust VR2 (GAIN SET) so that the signal level becomes 0.8V ± 0.02V. (Fig. 5-5)
- Reset the AGC ON/OFF switch to ON position.

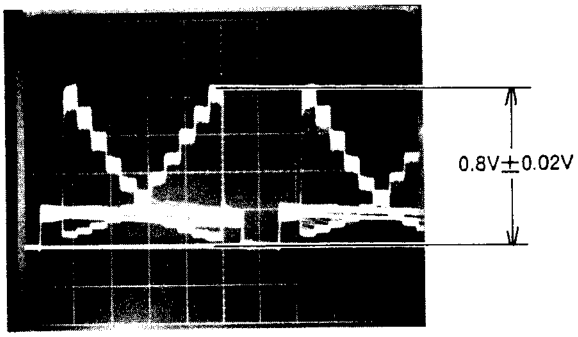


Fig. 5-5

(10) Video level adjustment

Test point :	**VIDEO OUT**	**Rear Panel**
Adjust :	**VR4 (Y LEVEL)**	**Process board**

- Aim the camera at logarithmic gray scale chart.
- Connect the 75 ohms terminated oscilloscope to VIDEO OUT connector.
- Trigger the oscilloscope at H rate.
- Adjust VR4 (Y LEVEL) so that the video level becomes 0.7V ± 0.03V. (Fig.5-6)
- Confirm that signal level is notchanged when AGC ON/OFF switch is switched to ON and OFF. If not, readjust VR3 and VR2 on the Process board while referring to (9) Gain adjustment.

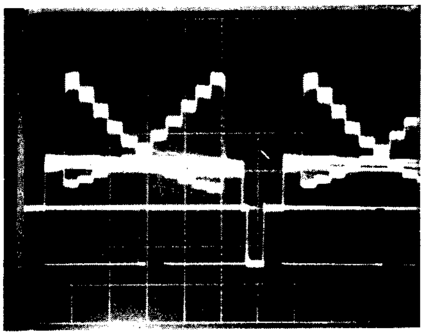
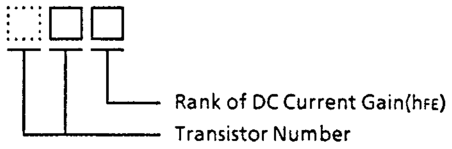


Fig.5-6

CHIP COMPONENTS

1. Chip Transistor

The transistor number is indicated on the top surface of the chip transistor using two alphabet letters or one numerical and two alphabet letters.


Rank of DC Current Gain(hFE)
Transistor Number

Transistor Number

(Chip Transistor)

Letter	Transister No.	Letter	Transister No.
A	2SB709	X	2SD602A
B	2SB709A	Y	2SD601
C	2SB710	Z	2SD601A
D	2SB710A	1A	2SB799
E	2SA1022	1B	2SB814
F	2SA1034	1C	2SB902
H	2SA1035	1F	2SK321
I	2SB792	1K	2SK316
K	2SC2778	1L	2SK247
P	2SD814	1M	2SJ84
Q	2SD813	1N	2SK199
R	2SC2480	1O	2SK198
S	2SC2405	1T	2SC3077
T	2SC2406	1X	2SC2845
U	2SC2404	1Z	2SD1030
V	2SC2295	2B	2SK374
W	2SD602	2C	2SK116

(Small Chip Transistor)

Letter	Transister No.
A	2SB1218
U	2SC3931
W	2SD1820
Y	2SD1819
E3	2SA1226
OS	2SB1219
UC	2SA1532
YU	2SC3938

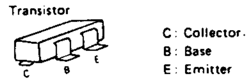
(Pair Transistor)

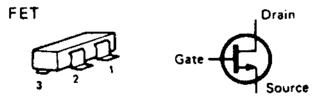
Letter	Transister No.
5C	XN4601
5N	XN6501
5O	XN6401

Example :

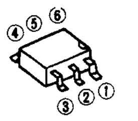
WQ ⟶ 2SD602 - Q
YQ ⟶ 2SD601 - Q
1BS ⟶ 2SB814 - S

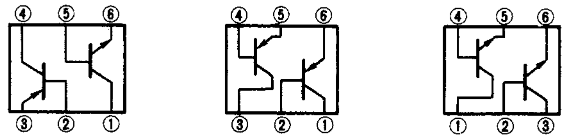
Appearance and Symbols


Transistor
C
B
E
C : Collector
B : Base
E : Emitter


FET
3
2
1
Drain
Gate
Source

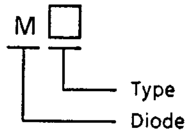
	1	2	3
Except 2SK199	Drain	Source	Gate
2SK199	Gate	Drain	Source




④ ⑤ ⑥
③ ② ①
④ ⑤ ⑥
③ ② ①
④ ⑤ ⑥
① ② ③

2. Chip Diode

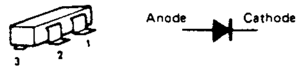
The diode number is indicated on the top surface of the chip diode using Two alphabet letters.


M
Type
Diode

Diode Number

Letter	Diode No.	Letter	Diode No.
MA	MA151A	MI	MA152K
MB	MA152A	MK	MA28W-B
MC	MA153	ML	MA28T-A
MD	MA28-A	MN	MA151WA
ME	MA28-B	MO	MA152WA
MF	MA28W-A	MT	MA151WK
MH	MA151K	MU	MA152WK

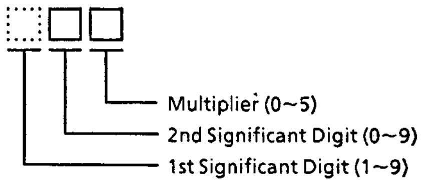
Appearance and Symbols


3
2
1
Anode
Cathode

	1	2	3
MA28/MA28W/MA28T	-	Anode	Cathode
MA151K/MA152K	-	Anode	Cathode
MA151A/MA152A	-	Cathode	Anode
MA151WK/MA152WK	Anode	Anode	Cathode
MA151WA/MA152WA	Cathode	Cathode	Anode
MA153	Cathode	Anode	Common

3. Chip Resistor

The resistor value is indicated on the bottom surface of the chip resistor using three digit numbers.


Multiplier (0~5)
2nd Significant Digit (0~9)
1st Significant Digit (1~9)

Example :

330 ⟶ 33×10^0 = 33 ohms
561 ⟶ 56×10^1 = 560 ohms
123 ⟶ 12×10^3 = 12 ohms

Note : Zero ohm resistor (jumper chip) is colored red or green.

4. Chip Capacitor

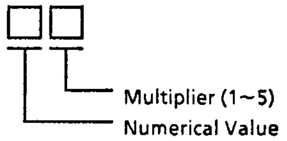
The capacitive value of replacement chip capacitors is indicated on the bottom surface. Original parts do not have value indication.

If the capacitive value is less than 100 pF, the value will be indicated by one or two digit number expressing the capacity directly in pF.

Example :

0.5 ⟶ 0.5 pF
75 ⟶ 0.75 pF
1 ⟶ 1 pF
2.5 ⟶ 2.5 pF
33 ⟶ 33 pF
82 ⟶ 82 pF

If the capacitive value is 100 pF or greater, the value will be indicated by an alpha-numeric code. The letter precedes the number and expresses a numerical value to be multiplied by the number which follows.


Multiplier (1~5)
Numerical Value

Numerical Value

Letter	Value	Letter	Value
A	10	N	33
B	11	P	36
C	12	O	39
D	13	R	43
E	15	S	47
F	16	T	51
G	18	U	56
H	20	V	62
J	22	W	68
K	24	X	75
L	27	Y	82
M	30	Z	91

*Letters I and O are not used

Example :

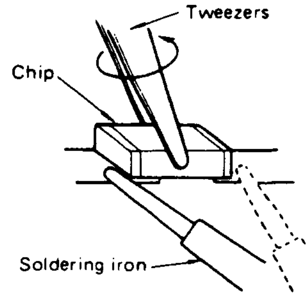
A1 ⟶ 10×10^1 = 100 pF
N2 ⟶ 33×10^2 = 3300 pF
S3 ⟶ 47×10^3 = 47000 pF

5. Precautions in replacing the chip component

1. Make sure that the unit is turned OFF when replacing the chip.
2. Use tweezers to prevent any damage to the chip surface.
3. Do not re-use the chips after removal.
4. Do not rub the electrode of chips.
5. Do not subject the chips to excessive stress.
6. It is recommended that a pencil-type soldering iron to be used.
7. The solder whose diameter is less than 0.5 mm is recommended.
8. Do not heat the chip beyond 3 seconds.
9. Maintain temperature control under 260°C (500°F) when soldering.

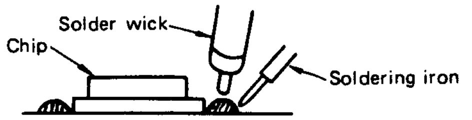
5-1 Removal (Transistor, Diode, Resistor and Capacitor)

1. Add the solder to both ends of the chip (three leads for chip transistor).
2. While attaching the soldering iron to both ends of the chip (three leads for chip transistor) as shown below, remove the chip by turning it with tweezers.
   Note : Be careful not to damage other chips.

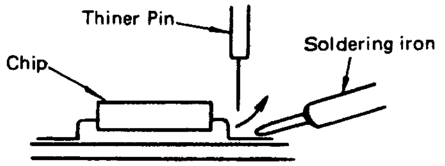

Tweezers
Chip
Soldering iron

5-2 Removal (IC)

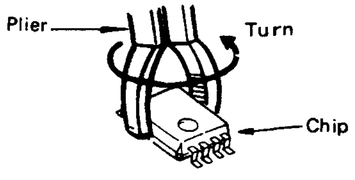
1. Add the solder wick and solder iron to each lead of the IC and remove solder.


Solder wick
Chip
Soldering iron

2. Add the solder iron to each lead of the IC and left each lead of the IC using thiner pin.

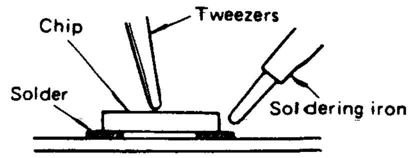

Thiner Pin
Soldering iron
Chip

3. Remove IC turning it with plier.

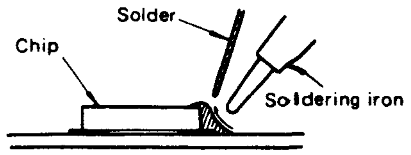

Plier
Turn
Chip

5-3 Mounting

1. Place the solder thinly on the chip mounting foil.
2. Solder the chip temporarily while holding the chip with the tweezers.

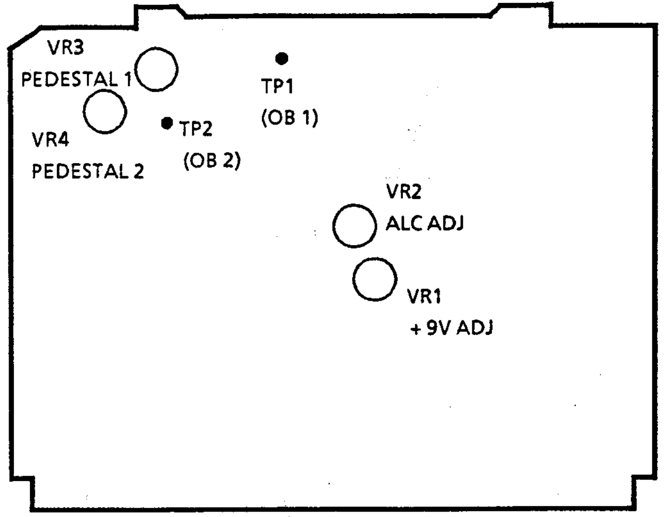

Chip
Tweezers
Solder
Soldering iron

3. Solder both ends of chip (three leads for chip transistor).

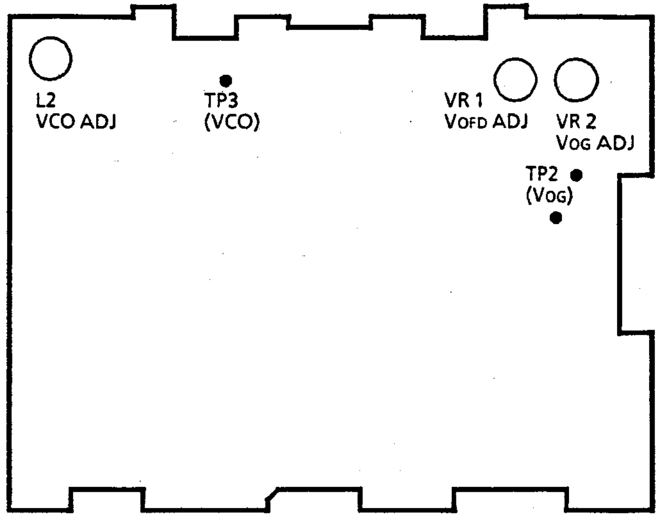

Solder
Chip
Soldering iron

LOCATION OF TEST POINTS AND ADJUSTING CONTROLS

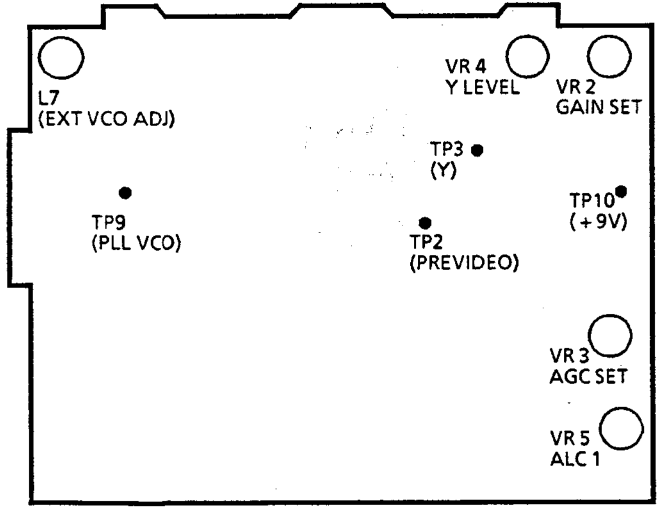
CONTROL BOARD


VR3
PEDESTAL 1
TP1
(OB 1)
VR4
PEDESTAL 2
TP2
(OB 2)
VR2
ALC ADJ
VR1
+ 9V ADJ

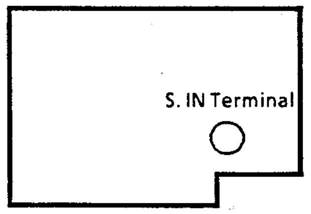
DRIVE BOARD


L2
VCO ADJ
TP3
(VCO)
VR 1
VOFD ADJ
VR 2
VOG ADJ
TP2
(VOG)

PROCESS BOARD

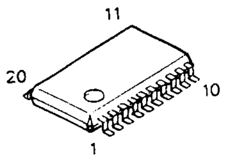

L7
(EXT VCO ADJ)
VR 4
Y LEVEL
VR 2
GAIN SET
TP3
(Y)
TP9
(PLL VCO)
TP2
(PREVIDEO)
TP10
(+9V)
VR 3
AGC SET
VR 5
ALC 1

PROCESS SUB BOARD

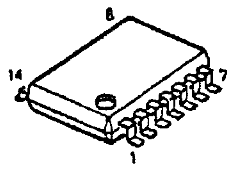

S. IN Terminal

APPEARANCE OF IC, TRANSISTOR AND DIODE

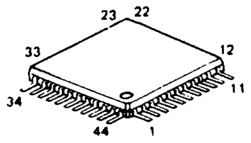
YWUPD6147G



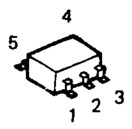
MN74HCU04S
TC40H000F



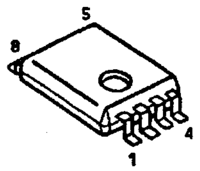
YWTC6003F
YWTC6013U
AN2050FB
YWPD65012GB


23
22
33
12
34
11
44
1

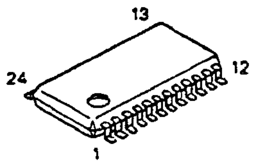
YWTC4S69F



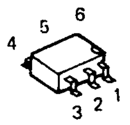
NJM3414M
MN6287S
BA226AF



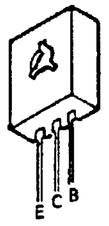
YWM51269FP



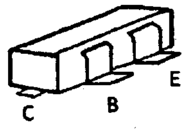
XN6401
XN6501



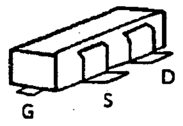
2SA886-QR
2SC1568-ST



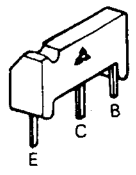
2SC3931-CD 2SD1820-QRS
2SD1819-QRS 2SC3303-0Y
2SB1218-QRS 2SD601-RS
2SD602-QRS 2SB709-QRS



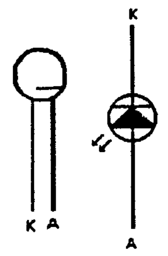
2SK662-PQR



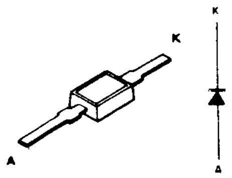
2SD973-QRS
2SB793-RS



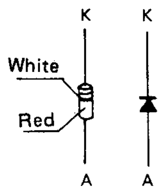
LN25RCP



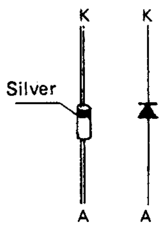
ISV153



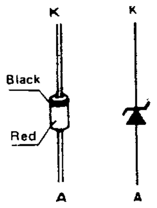
MA170


K
K
White
Red
A
A

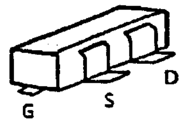
EU01AV0


K
K
Silver
A
A

RD22EB4
RD13EB1
HZ6C2L

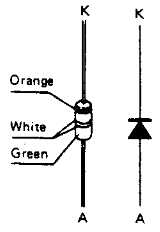

K
K
Black
Red
A
A

MA151K

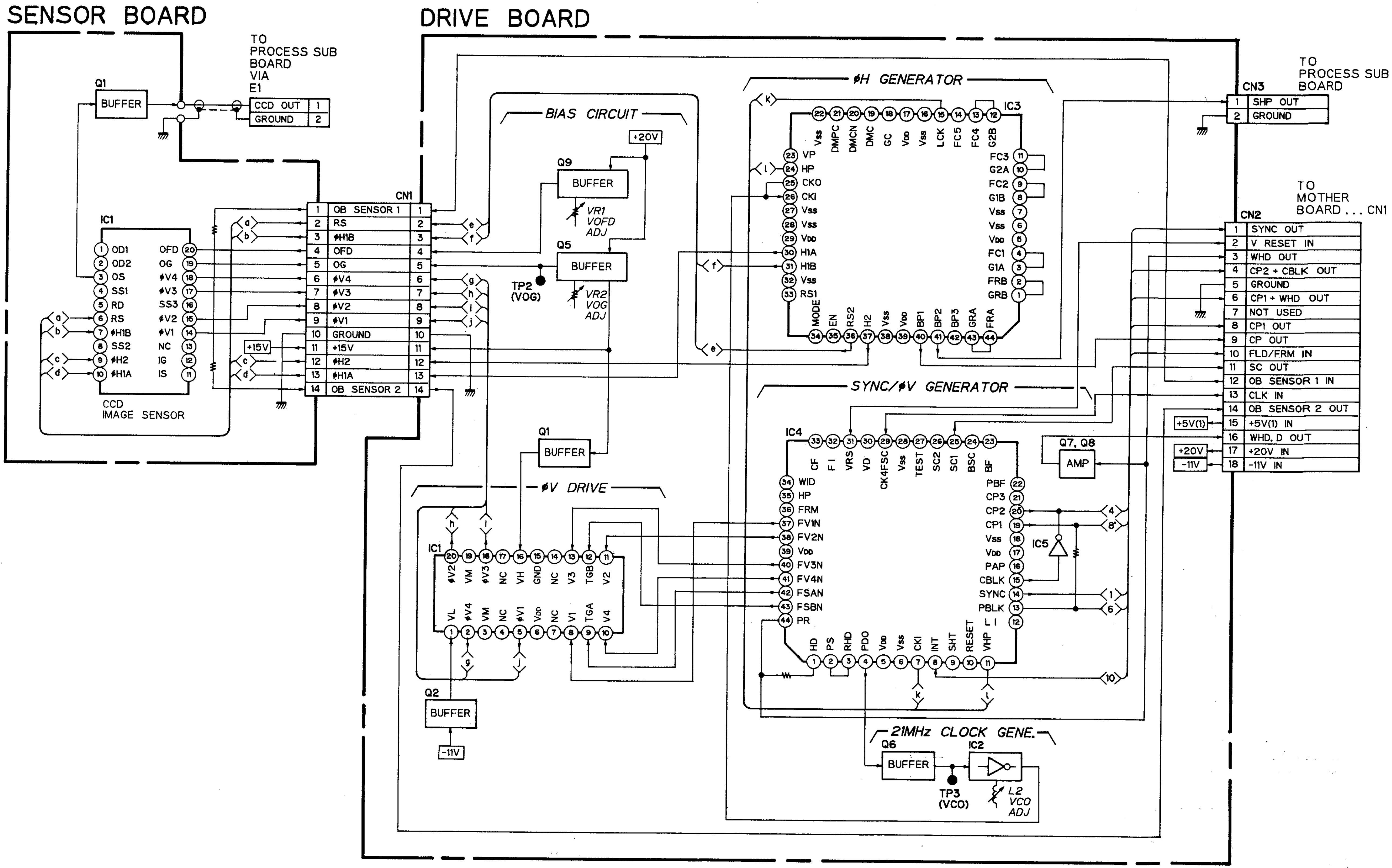


1 : NC
2 : Anode
3 : Cathode

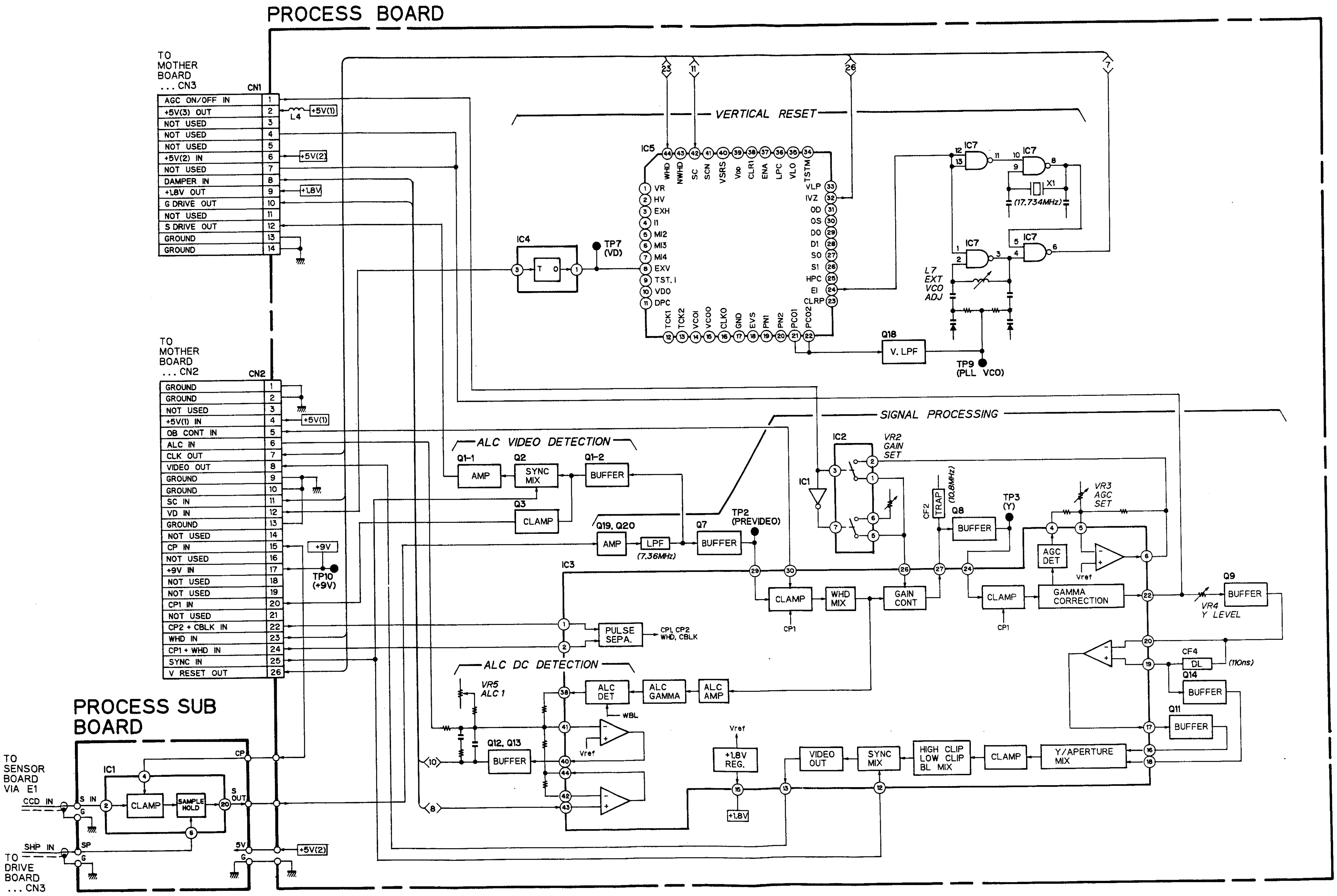
MA4039H


K
K
Orange
White
Green
A
A

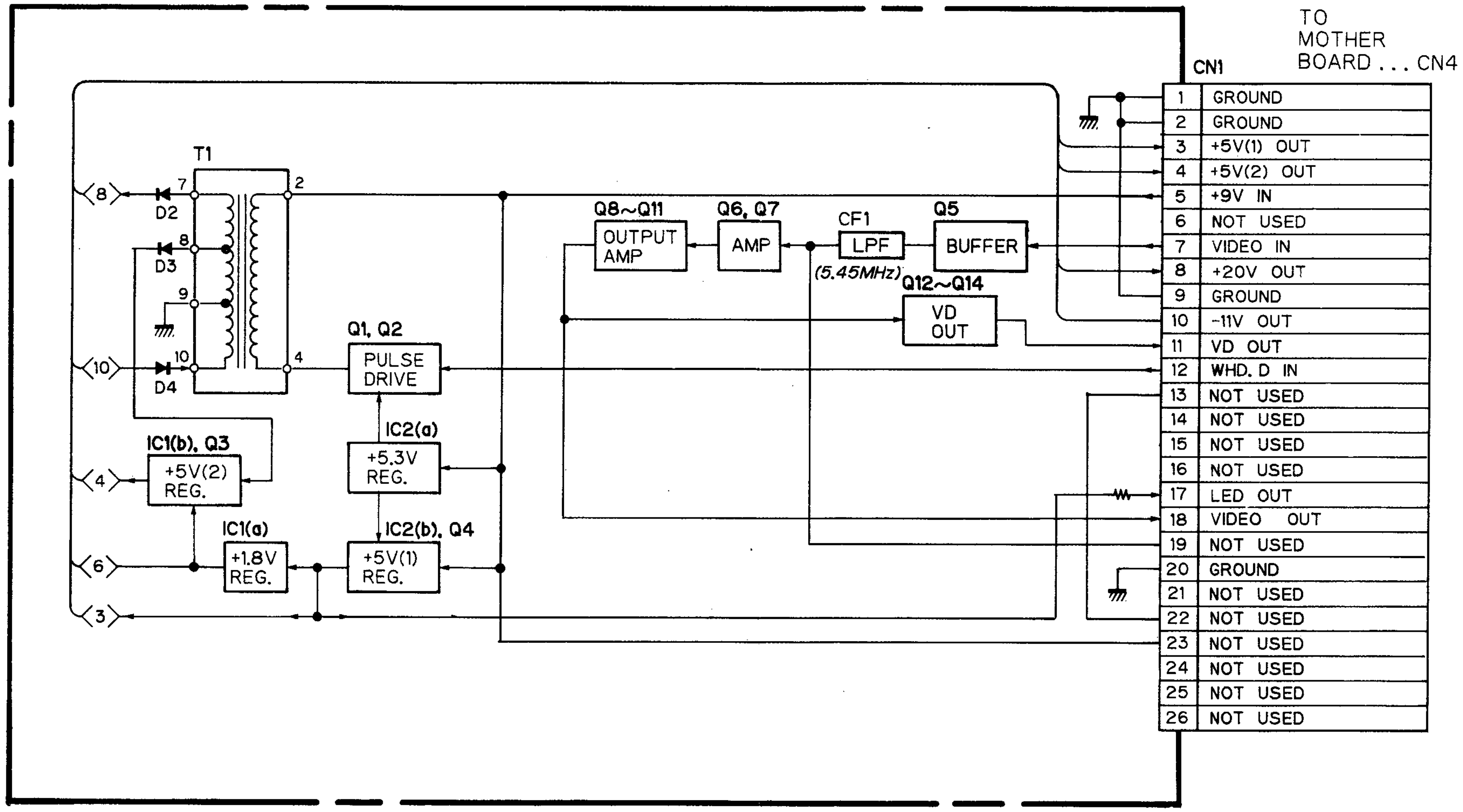
BLOCK DIAGRAM OF SENSOR BOARD, DRIVE BOARD


SENSOR BOARD
DRIVE BOARD
TO PROCESS SUB BOARD VIA E1
CCD OUT 1
GROUND 2
Q1
BUFFER
IC1
OD1 OD2 OS SS1 RD RS ϕH1B SS2 ϕH2 ϕH1A
OFD OG ϕV4 ϕV3 SS3 ϕV2 ϕV1 NC IG IS
CCD IMAGE SENSOR
CN1
1 OB SENSOR 1
2 RS
3 ϕH1B
4 OFD
5 OG
6 ϕV4
7 ϕV3
8 ϕV2
9 ϕV1
10 GROUND
11 +15V
12 ϕH2
13 ϕH1A
14 OB SENSOR 2
+15V
BIAS CIRCUIT
+20V
Q9 BUFFER
VR1 VOFD ADJ
Q5 BUFFER
TP2 (VOG)
VR2 VOG ADJ
Q1 BUFFER
ϕV DRIVE
IC1
ϕV2 VM ϕV3 NC VH GND NC V3 TGB V2
VL ϕV4 VM NC ϕV1 VDD NC V1 TGA V4
Q2 BUFFER
-11V
ϕH GENERATOR
IC3
Vss DMPC DMCN DMC GC VDD Vss LCK FC5 FC4 G2B
VP HP CKO CKI Vss Vss VDD H1A H1B Vss RS1
FC3 G2A FC2 G1B Vss Vss VDD FC1 G1A FRB GRB
MODE EN RS2 H2 Vss VDD BP1 BP2 BP3 GRA FRA
SYNC/ϕV GENERATOR
IC4
CF FI VRS VD CK4FSC Vss TEST SC2 SC1 BSC BF
WID HP FRM FV1N FV2N VDD FV3N FV4N FSAN FSBN PR
PBF CP3 CP2 CP1 Vss VDD PAP CBLK SYNC PBLK L I
HD PS RHD PDO VDD Vss CKI INT SHT RESET VHP
IC5
Q7, Q8 AMP
21MHz CLOCK GENE.
Q6 BUFFER
IC2
TP3 (VCO)
L2 VCO ADJ
CN3
TO PROCESS SUB BOARD
1 SHP OUT
2 GROUND
TO MOTHER BOARD . . . CN1
CN2
1 SYNC OUT
2 V RESET IN
3 WHD OUT
4 CP2 + CBLK OUT
5 GROUND
6 CP1 + WHD OUT
7 NOT USED
8 CP1 OUT
9 CP OUT
10 FLD/FRM IN
11 SC OUT
12 OB SENSOR 1 IN
13 CLK IN
14 OB SENSOR 2 OUT
15 +5V(1) IN
16 WHD, D OUT
17 +20V IN
18 -11V IN
+5V(1)
+20V
-11V

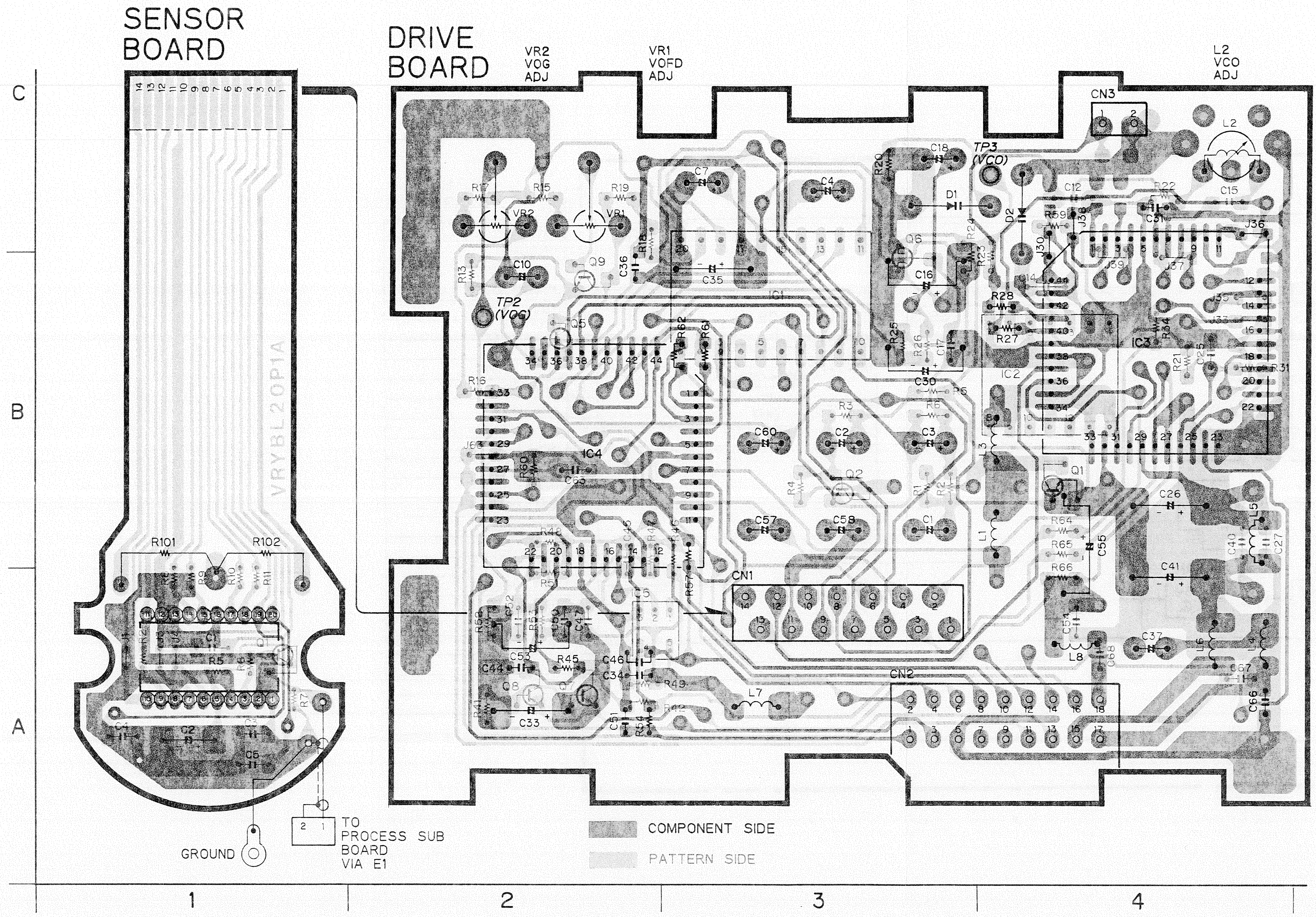
BLOCK DIAGRAM OF PROCESS BOARD


PROCESS BOARD
TO MOTHER BOARD ... CN3
CN1
1 AGC ON/OFF IN
2 +5V(3) OUT
3 NOT USED
4 NOT USED
5 NOT USED
6 +5V(2) IN
7 NOT USED
8 DAMPER IN
9 +1.8V OUT
10 G DRIVE OUT
11 NOT USED
12 S DRIVE OUT
13 GROUND
14 GROUND
L4
+5V(1)
+5V(2)
+1.8V
TO MOTHER BOARD ... CN2
CN2
1 GROUND
2 GROUND
3 NOT USED
4 +5V(1) IN
5 OB CONT IN
6 ALC IN
7 CLK OUT
8 VIDEO OUT
9 GROUND
10 GROUND
11 SC IN
12 VD IN
13 GROUND
14 NOT USED
15 CP IN
16 NOT USED
17 +9V IN
18 NOT USED
19 NOT USED
20 CP1 IN
21 NOT USED
22 CP2 + CBLK IN
23 WHD IN
24 CP1 + WHD IN
25 SYNC IN
26 V RESET OUT
+9V
TP10 (+9V)
VERTICAL RESET
IC4
T O
TP7 (VD)
IC5
WHD NWHD SC SCN VSRS VDD CLR1 ENA LPC VLO TSTM
VR HV EXH I1 MI2 MI3 MI4 EXV TST.I VDO DPC
VLP IVZ OD OS DO D1 SO S1 HPC EI CLRP
TCK1 TCK2 VCOI VCOO CLKO GND EVS PN1 PN2 PCO1 PCO2
IC7
X1
(17.734MHz)
L7 EXT VCO ADJ
Q18
V. LPF
TP9 (PLL VCO)
23 11 26 7
SIGNAL PROCESSING
IC2
VR2 GAIN SET
IC1
CF2 TRAP (10.8MHz)
Q8 BUFFER
TP3 (Y)
VR3 AGC SET
AGC DET
Vref
ALC VIDEO DETECTION
Q1-1 AMP
Q2 SYNC MIX
Q1-2 BUFFER
Q3 CLAMP
Q19, Q20 AMP
LPF (7.36MHz)
Q7 BUFFER
TP2 (PREVIDEO)
IC3
CLAMP
WHD MIX
GAIN CONT
CLAMP
GAMMA CORRECTION
CP1
CP1
Q9 BUFFER
VR4 Y LEVEL
PULSE SEPA.
CP1, CP2 WHD, CBLK
CF4 DL (110ns)
Q14 BUFFER
Q11 BUFFER
ALC DC DETECTION
VR5 ALC 1
ALC DET
ALC GAMMA
ALC AMP
WBL
Vref
Q12, Q13 BUFFER
Vref
+1.8V REG.
+1.8V
VIDEO OUT
SYNC MIX
HIGH CLIP LOW CLIP BL MIX
CLAMP
Y/APERTURE MIX
PROCESS SUB BOARD
TO SENSOR BOARD VIA E1
CCD IN
S IN
G
IC1
CLAMP
SAMPLE HOLD
CP
S OUT
SHP IN
SP
TO DRIVE BOARD ... CN3
5V
G
+5V(2)

BLOCK DIAGRAM OF DC/DC BOARD


TO
MOTHER
BOARD . . . CN4
CN1
T1
D2
D3
D4
7
8
9
10
2
4
8
10
4
6
3
Q1, Q2
PULSE DRIVE
IC2(a)
+5.3V REG.
IC2(b), Q4
+5V(1) REG.
IC1(a)
+1.8V REG.
IC1(b), Q3
+5V(2) REG.
Q8~Q11
OUTPUT AMP
Q6, Q7
AMP
CF1
LPF
(5.45MHz)
Q5
BUFFER
Q12~Q14
VD OUT
1 GROUND
2 GROUND
3 +5V(1) OUT
4 +5V(2) OUT
5 +9V IN
6 NOT USED
7 VIDEO IN
8 +20V OUT
9 GROUND
10 -11V OUT
11 VD OUT
12 WHD. D IN
13 NOT USED
14 NOT USED
15 NOT USED
16 NOT USED
17 LED OUT
18 VIDEO OUT
19 NOT USED
20 GROUND
21 NOT USED
22 NOT USED
23 NOT USED
24 NOT USED
25 NOT USED
26 NOT USED

CONDUCTOR VIEW OF SENSOR BOARD, DRIVE BOARD


SENSOR BOARD
DRIVE BOARD
VR2 VOG ADJ
VR1 VOFD ADJ
L2 VCO ADJ
TP2 (VOG)
TP3 (VCO)
CN1
CN2
CN3
IC1
IC2
IC3
IC4
R101
R102
VRYBL20P1A
GROUND
TO PROCESS SUB BOARD VIA E1
COMPONENT SIDE
PATTERN SIDE
C
B
A
1
2
3
4

<ADDRESS INFORMATION>

SENSOR BOARD

IC1	A1
Q1	A1

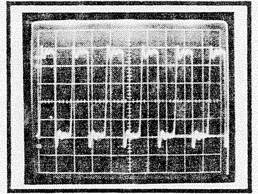
<ADDRESS INFORMATION>

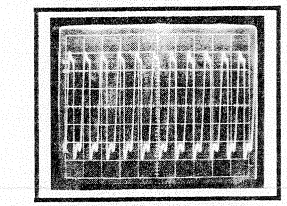
DRIVE BOARD

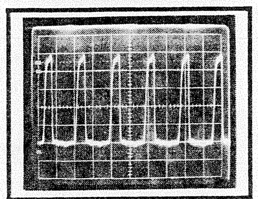
IC1	B3,C3
IC2	B4
IC3	B4,C4
IC4	B2,B3
IC5	A2,A3
Q1	B4
Q2	B3
Q5	B2
Q6	B3,C3
Q7	A2
Q8	A2
Q9	B2
D1	C3
D2	C4

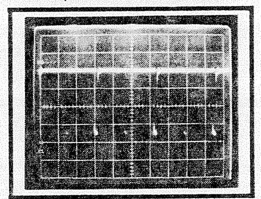
Note :
1. CCD image sensor (IC1) and thermo-detection resistors (R101/R102) are not included in the Sensor board assembly. They are included in a CCD image sensor assembly.
2. When replacing CCD image sensor assembly, make sure to replace the thermo-detection resistors on the Sensor board supplied together with CCD image sensor assembly.

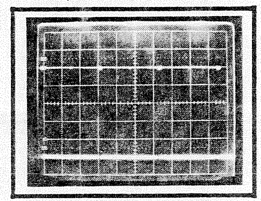
Drive Board

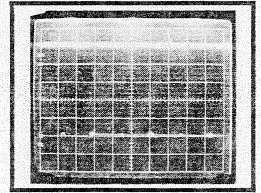

1. 50nsec/DIV, 1V/DIV

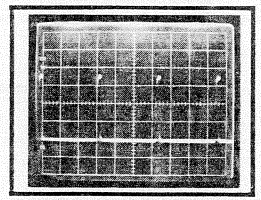

2. 50nsec/DIV, 1V/DIV

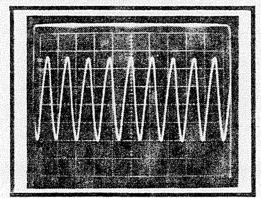

3. 50nsec/DIV, 1V/DIV

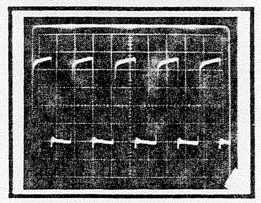

4. 20μsec/DIV, 2V/DIV

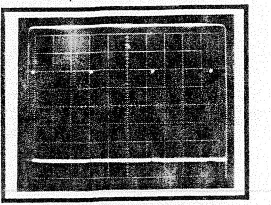

5. 20μsec/DIV, 1V/DIV

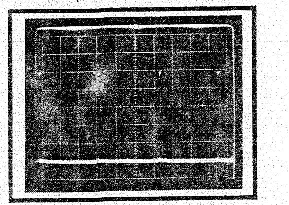

6. 20μsec/DIV, 1V/DIV

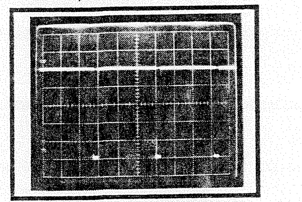

7. 20μsec/DIV, 2V/DIV

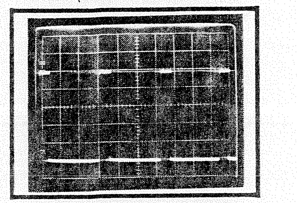

8. 50nsec/DIV, 0.5V/DIV

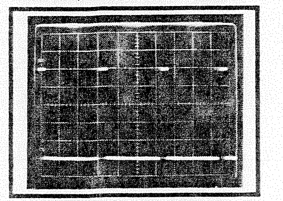

9. 0.1μsec/DIV, 1V/DIV

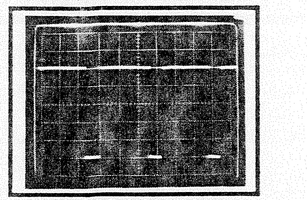

10. 20μsec/DIV, 1V/DIV

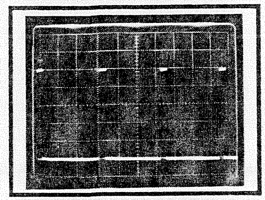

11. 20μsec/DIV, 1V/DIV

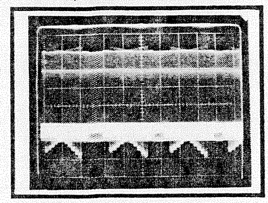

12. 20μsec/DIV, 1V/DIV

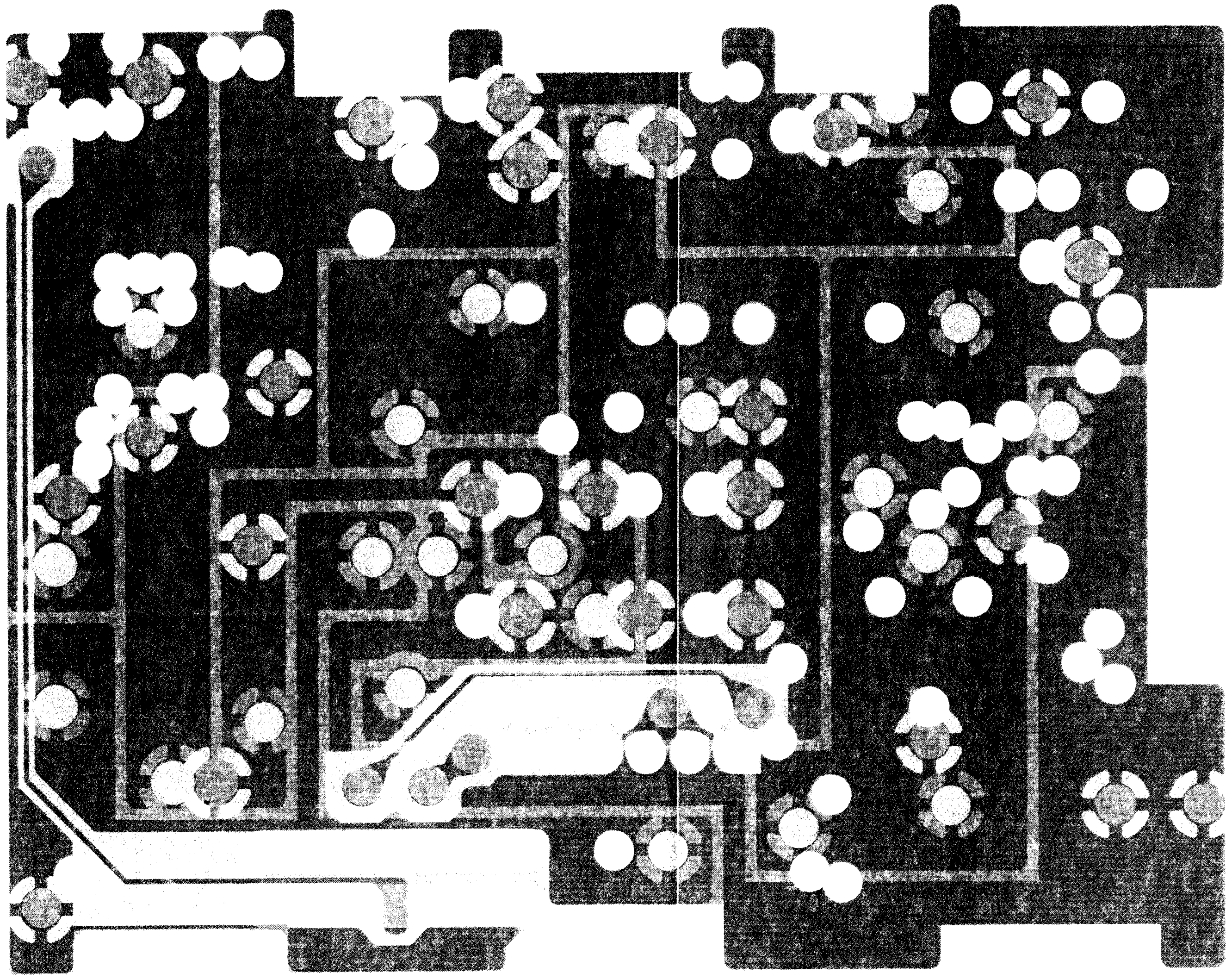

13. 20μsec/DIV, 1V/DIV

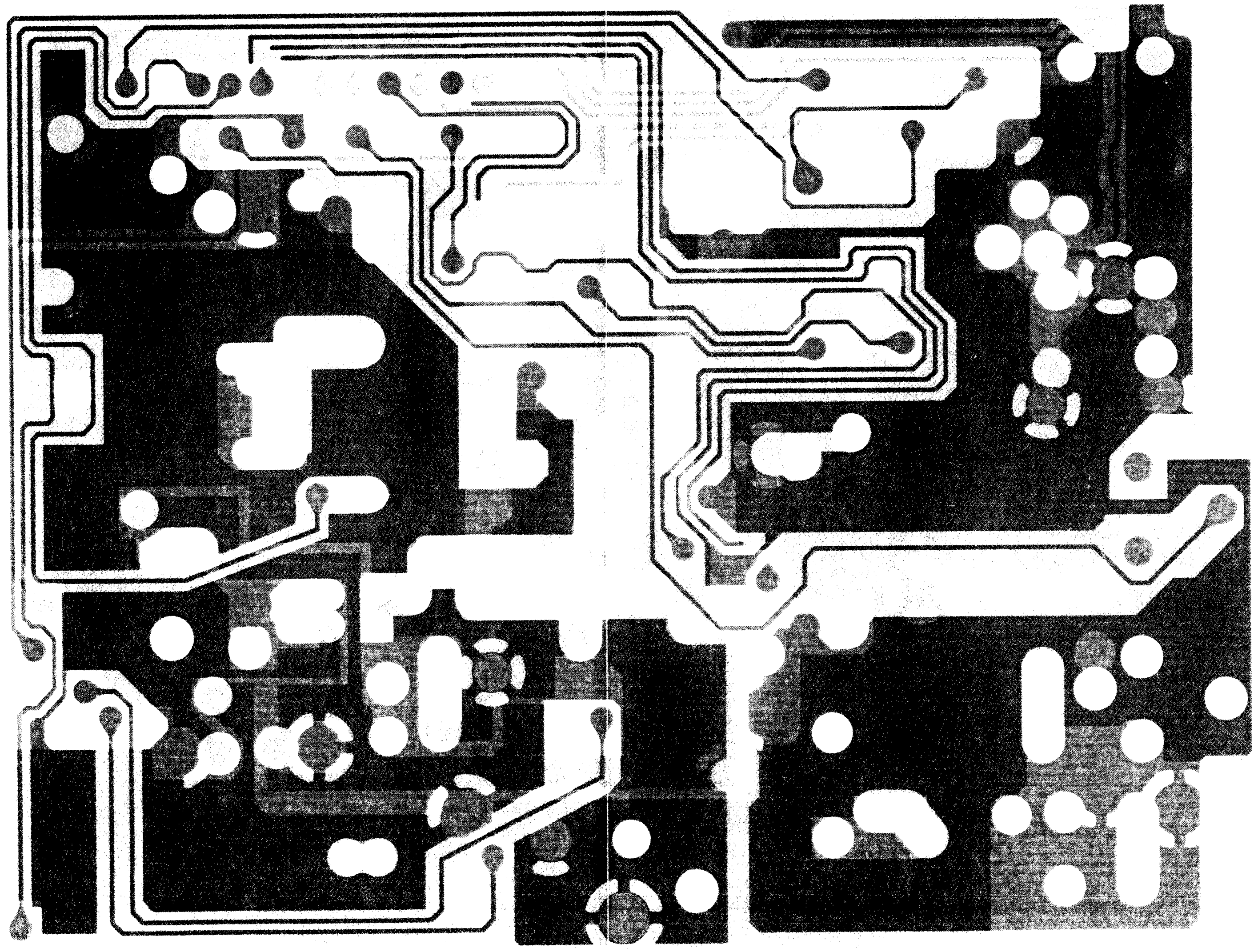

14. 20μsec/DIV, 1V/DIV


15. 20μsec/DIV, 1V/DIV

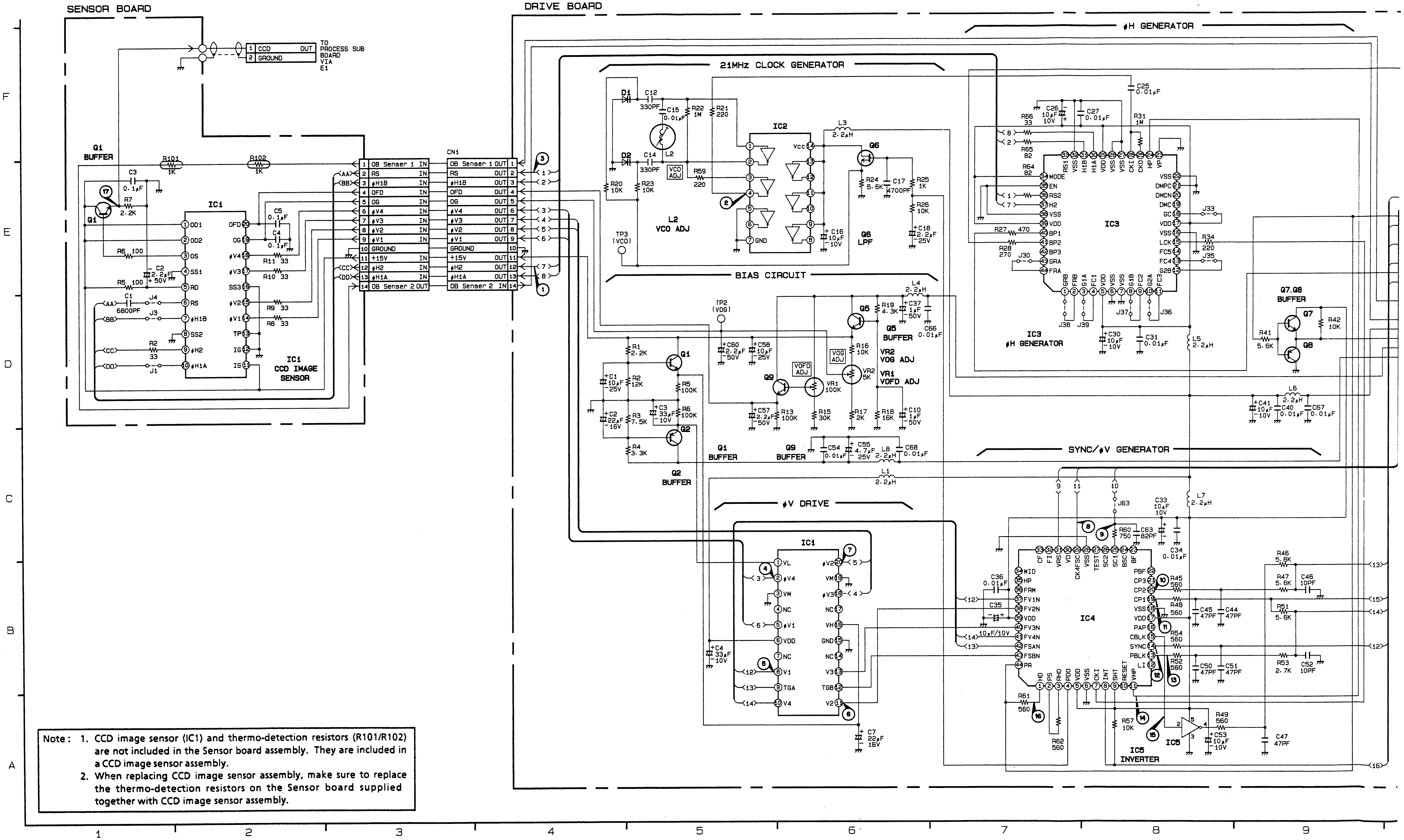

16. 20μsec/DIV, 1V/DIV


17. 20μsec/DIV, 0.1V/DIV





SCHEANATIC DIAGRAM OF SENSOR BOARD, DRIVE BOARD

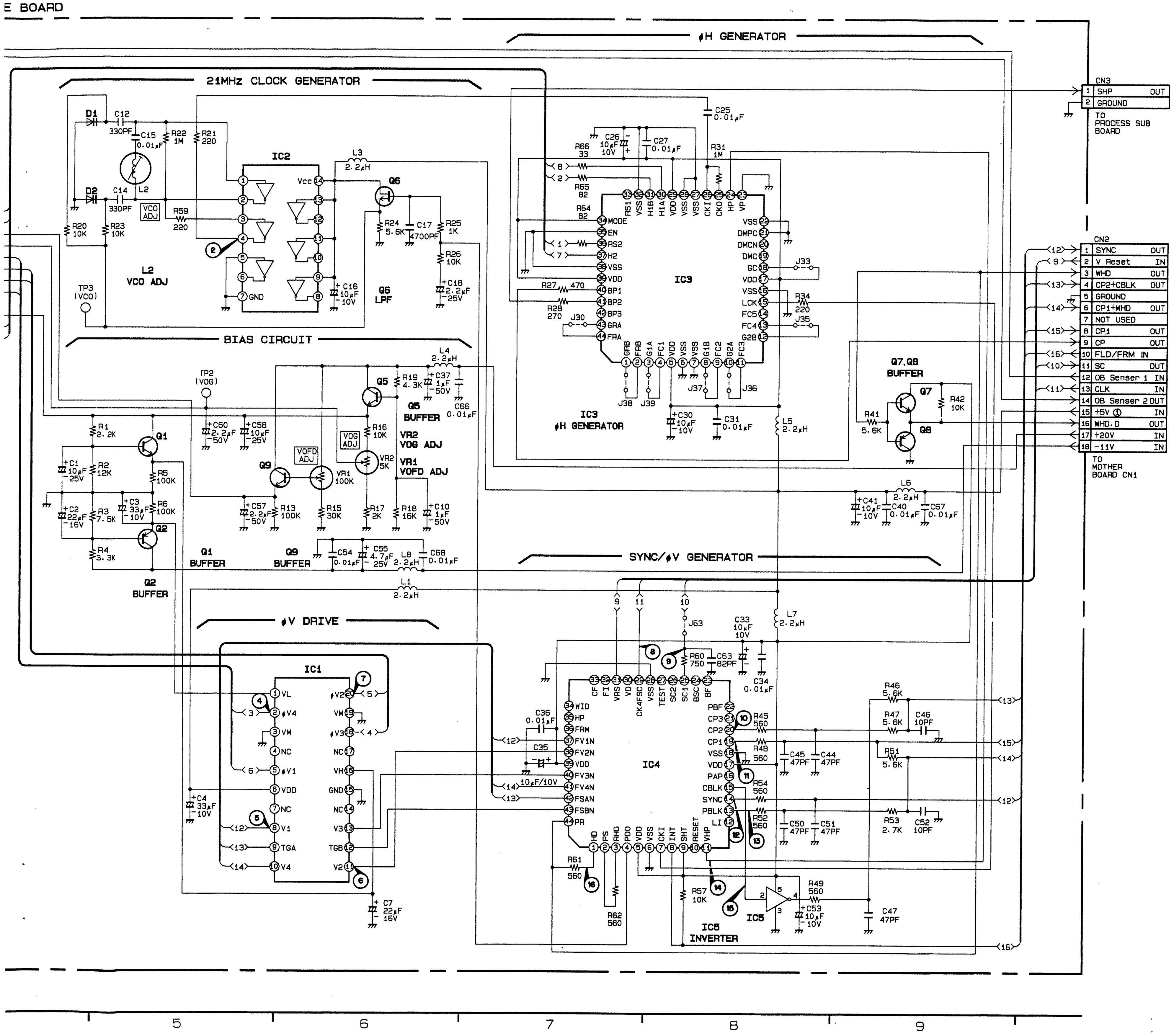


SENSOR BOARD
DRIVE BOARD
TO PROCESS SUB BOARD VIA E1
1 CCD OUT
2 GROUND
Q1 BUFFER
R101 1K
R102 1K
IC1
IC1 CCD IMAGE SENSOR
CN1
1 OB Senser 1 IN
2 RS IN
3 ϕH1B IN
4 OFD IN
5 OG IN
6 ϕV4 IN
7 ϕV3 IN
8 ϕV2 IN
9 ϕV1 IN
10 GROUND
11 +15V IN
12 ϕH2 IN
13 ϕH1A IN
14 OB Senser 2 OUT
OB Senser 1 OUT 1
RS OUT 2
ϕH1B OUT 3
OFD OUT 4
OG OUT 5
ϕV4 OUT 6
ϕV3 OUT 7
ϕV2 OUT 8
ϕV1 OUT 9
GROUND 10
+15V OUT 11
ϕH2 OUT 12
ϕH1A OUT 13
OB Senser 2 IN 14
21MHz CLOCK GENERATOR
IC2
L2 VCO ADJ
Q6 LPF
TP3 (VCO)
BIAS CIRCUIT
TP2 (VOG)
Q5 BUFFER
VR2 VOG ADJ
VR1 VOFD ADJ
Q1 BUFFER
Q9 BUFFER
Q2 BUFFER
ϕH GENERATOR
IC3
IC3 ϕH GENERATOR
Q7,Q8 BUFFER
ϕV DRIVE
IC1
SYNC/ϕV GENERATOR
IC4
IC5
IC5 INVERTER
F
E
D
C
B
A
1
2
3
4
5
6
7
8
9

Note : 1. CCD image sensor (IC1) and thermo-detection resistors (R101/R102) are not included in the Sensor board assembly. They are included in a CCD image sensor assembly.

2. When replacing CCD image sensor assembly, make sure to replace the thermo-detection resistors on the Sensor board supplied together with CCD image sensor assembly.

SCHEANATIC DIAGRAM OF SENSOR BOARD, DRIVE BOARD


E BOARD
21MHz CLOCK GENERATOR
BIAS CIRCUIT
ϕH GENERATOR
SYNC/ϕV GENERATOR
ϕV DRIVE
IC1
IC2
IC3
ϕH GENERATOR
IC4
IC5
INVERTER
L2
VCO ADJ
TP3 (VCO)
TP2 (VOG)
Q6
LPF
Q5
BUFFER
VR2
VOG ADJ
VR1
VOFD ADJ
Q1
BUFFER
Q9
BUFFER
Q2
BUFFER
Q7,Q8
BUFFER
CN3
1 SHP OUT
2 GROUND
TO PROCESS SUB BOARD
CN2
1 SYNC OUT
2 V Reset IN
3 WHD OUT
4 CP2+CBLK OUT
5 GROUND
6 CP1+WHD OUT
7 NOT USED
8 CP1 OUT
9 CP OUT
10 FLD/FRM IN
11 SC OUT
12 OB Senser 1 IN
13 CLK IN
14 OB Senser 2 OUT
15 +5V ① IN
16 WHD.D OUT
17 +20V IN
18 -11V IN
TO MOTHER BOARD CN1
5
6
7
8
9

<VOLTAGES>

	IC1	IC2	IC3	IC4	IC5
Pin 1	-6.9	2.3	1.6	0.5	0
2	-0.4	2.5	1.6	0.6	3.8
3	0	2.7	1.7	0.5	0
4	0	2.7	1.6	1.7	1.2
5	-0.4	0	4.6	4.9	5.0
6	5.0	5.0	0	0	
7	0	0	0	2.1	
8	0.3	0	1.6	4.9	
9	5.0	5.0	0	4.9	
10	0.3	0	1.7	4.9	
11	4.6	5.0	1.7	0.7	
12	5.0	0	1.7	2.5	
13	4.6	5.0	1.7	1.1	
14	0	5.0	1.7	4.5	
15	0		1.7	3.7	
16	12.0		0	2.5	
17	0		4.7	4.9	
18	-6.4		4.7	0	
19	0		0	0.1	
20	-6.4		4.7	0.2	
21			0	0	
22			0	0.2	
23			0	0.2	
24			1.0	4.8	
25			2.4	1.7	
26			2.2	1.7	
27			0	1.7	
28			0	0	
29			4.6	2.5	
30			2.6	0.3	
31			2.1	5.0	
32			0	2.1	
33			1.1	0	
34			4.6	4.0	
35			0	0.6	
36			1.1	0	
37			2.0	0.3	
38			0	4.6	
39			4.6	5.0	
40			0.8	4.6	
41			1.9	0.3	
42			0	4.9	
43			1.6	4.9	
44			1.6	0.5	

	B	C	E
Q1	12.4	15.0	11.8
Q2	-7.6	-11.1	-6.9
Q5	15.5	20.0	14.8
Q7	0.5	5.0	1.0
Q8	0.5	0	1.0
Q9	13.8	20.0	13.3

	G	D	S
Q6	1.7	5.0	2.2

<ADDRESS INFORMATION>

SENSOR BOARD

IC1	D2, E2
Q1	E1

<ADDRESS INFORMATION>

DRIVE BOARD

IC1	B6
IC2	E5, E6
IC3	E7, E8
IC4	B7, B8
IC5	A8
Q1	D5
Q2	C5
Q5	D6
Q6	E6
Q7	D9
Q8	D9
Q9	D6
D1	F4
D2	E4

<ADDRESS INFORMATION>

PROCESS BOARD

IC1	E2
IC2	F3
IC3	C3, C4, C5
IC4	F7
IC5	D9, E9
IC7	B8, C8
Q1	E2, E3
Q2	E2
Q3	E3
Q7	E4
Q8	E5
Q9	E6
Q11	E6
Q12	C2
Q13	C2
Q14	C6
Q18	C10
Q19	F4
Q20	F4
D1	C7
D2	B7

PROCESS SUB BOARD

IC1	G2

<VOLTAGES>

Process Board

	IC1	IC2	IC3	IC4	IC5	IC7
Pin 1	0	2.0	0.7	0	5.0	0
2	5.0	2.0	0.7	0	0	4.5
3	0	5.0	0	4.4	5.0	5.0
4	0	0	2.1	0	0	5.0
5	5.0	1.7	1.8	0	0	-0.8
6		1.9	1.5	0	0	2.2
7		0	3.1	0	0	0
8		5.0	2.6	5.0	0	-0.7
9			1.7		5.0	2.2
10			0		5.0	5.0
11			1.8		0	5.0
12			4.6		0	0
13			2.5		0	0
14			5.0		0	5.0
15			1.8		5.0	
16			2.5		0	
17			1.7		0	
18			2.0		5.0	
19			2.6		5.0	
20			0		5.0	
21			2.4		0	
22			2.1		0	
23			0.6		5.0	
24			2.1		0	
25			0.6		0.2	
26			0.6		0	
27			0.6		0	
28			0.6		0	
29			0.6		0	
30			0.6		0	
31			0.6		0	
32			0.6		5.0	
33			0		0	
34			0		5.0	
35			0		0	
36			0		0	
37			0		5.0	
38			2.3		5.0	
39			3.1		5.0	
40			0.8		5.0	
41			0		5.0	
42			2.3		2.3	
43			0.1		0	
44			4.2		0.5	

	Q1	Q2	Q3
Pin1	4.1	5.0	1.8
2	1.8	1.8	0.1
3	5.0	5.0	2.0
4	1.8	1.8	0.1
5	1.2	1.3	1.8
6	1.2	1.3	2.0

Process Sub Board

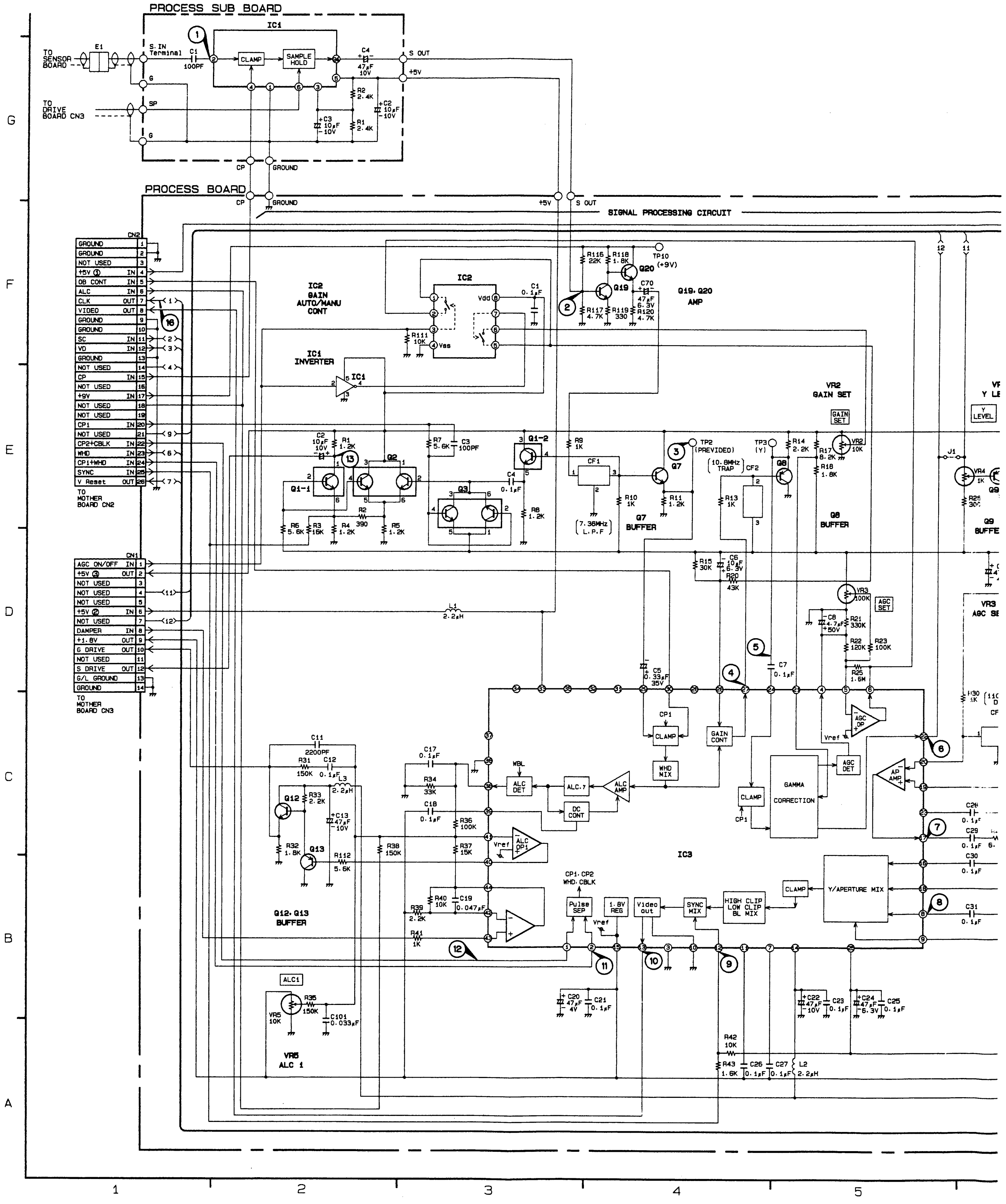
	IC1
Pin 1	0
2	2.5
3	2.5
4	1.4
5	5.0
6	1.0
7	0
8	0
9	1.0
10	0
11	0
12	0.3
13	0.1
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0.1
23	1.0
24	2.5

Process Board

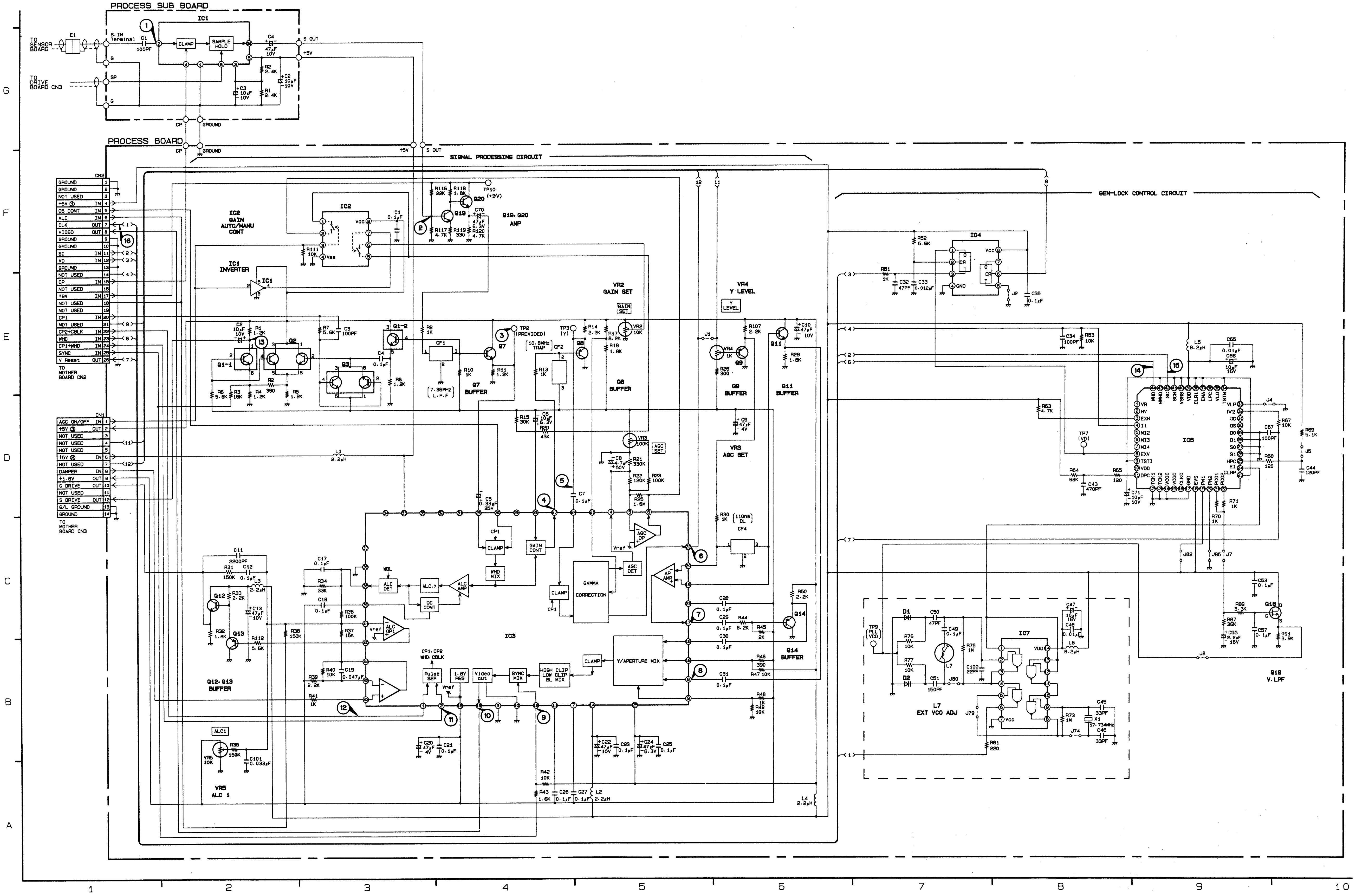
	B	C	E
Q7	1.8	5.0	1.2
Q8	1.8	0	2.5
Q9	1.9	0	2.6
Q11	2.6	5.0	2.0
Q12	1.4	5.0	0.8
Q13	0.8	0	1.4
Q14	1.8	0	2.5
Q19	1.5	4.3	0.8
Q20	4.3	9.2	3.7

	G	D	S
Q18	0	5.0	0.5

SCHEMATIC DIAGRAM OF PROCESS BOARD

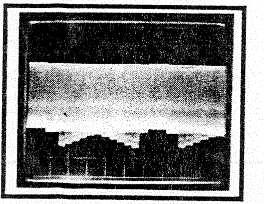

PROCESS SUB BOARD
IC1
S.IN Terminal
CLAMP
SAMPLE HOLD
S OUT
+5V
TO SENSOR BOARD
TO DRIVE BOARD CN3
CP
GROUND
PROCESS BOARD
SIGNAL PROCESSING CIRCUIT
IC2 GAIN AUTO/MANU CONT
IC1 INVERTER
Q19, Q20 AMP
VR2 GAIN SET
Q7 BUFFER
Q8 BUFFER
Q9 BUFFER
VR3 AGC SET
Q12, Q13 BUFFER
VR5 ALC 1
IC3
ALC DET
ALC AMP
DC CONT
WHD MIX
GAIN CONT
CLAMP
GAMMA CORRECTION
AGC DET
AGC OP
AP AMP
Y/APERTURE MIX
HIGH CLIP LOW CLIP BL MIX
SYNC MIX
Video out
1.8V REG
Pulse SEP
TO MOTHER BOARD CN2
TO MOTHER BOARD CN3
G
F
E
D
C
B
A
1
2
3
4
5

SCHEMATIC DIAGRAM OF PROCESS BOARD

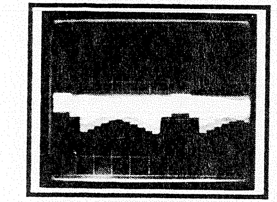

PROCESS SUB BOARD
IC1
CLAMP
SAMPLE HOLD
S.IN Terminal
TO SENSOR BOARD
TO DRIVE BOARD CN3
S OUT
+5V
CP
GROUND
PROCESS BOARD
SIGNAL PROCESSING CIRCUIT
GEN-LOCK CONTROL CIRCUIT
CN2
GROUND
NOT USED
+5V ①
DB CONT
ALC
CLK
VIDEO
SC
VD
CP
+9V
CP1
CP2+CBLK
WHD
CP1+WHD
SYNC
V Reset
TO MOTHER BOARD CN2
CN1
AGC ON/OFF
+5V ③
+5V ②
DAMPER
+1.8V
G DRIVE
S DRIVE
G/L GROUND
TO MOTHER BOARD CN3
IC2 GAIN AUTO/MANU CONT
IC1 INVERTER
Q19, Q20 AMP
TP10 (+9V)
VR2 GAIN SET
VR4 Y LEVEL
TP2 (PREVIDEO)
TP3 (Y)
(10.8MHz TRAP)
CF2
CF1
(7.36MHz L.P.F)
Q7 BUFFER
Q8 BUFFER
Q9 BUFFER
Q11 BUFFER
VR3 AGC SET
(110ns) DL
CF4
IC3
CLAMP
GAIN CONT
WHD MIX
GAMMA CORRECTION
AGC OP
AGC DET
AP AMP
ALC DET
ALC-7
ALC AMP
DC CONT
ALC OP1
Pulse SEP
1.8V REG
Video out
SYNC MIX
HIGH CLIP LOW CLIP BL MIX
Y/APERTURE MIX
Q12, Q13 BUFFER
Q14 BUFFER
VR5 ALC 1
IC4
IC5
IC7
TP7 (VD)
TP9 (PLL VCO)
L7 EXT VCO ADJ
Q18 V.LPF
X1 17.734MHz
1 2 3 4 5 6 7 8 9 10
A B C D E F G

Process Board

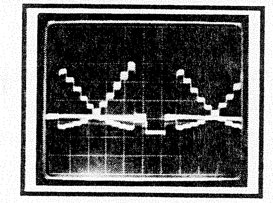
1. 1 0μsec/DIV, 0.2V/DIV



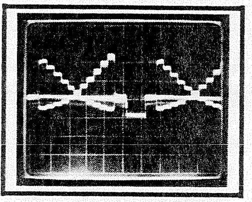
2. 10μsec/DIV, 0.05V/DIV



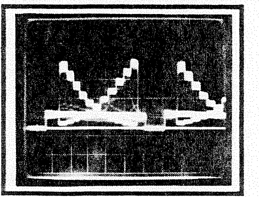
3. 10μsec/DIV, 0.05V/DIV



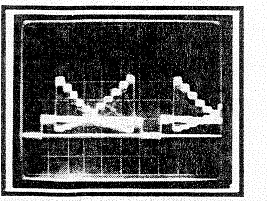
4. 10μsec/DIV, 0.2V/DIV



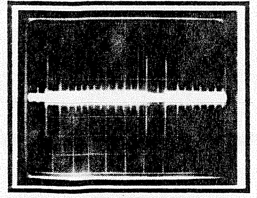
5. 10μsec/DIV, 0.2V/DIV



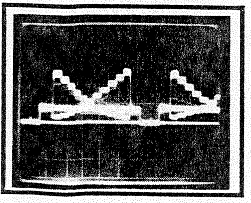
6. 10μsec/DIV, 0.2V/DIV



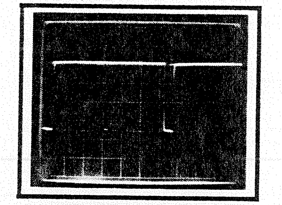
7. 10μsec/DIV, 0.2V/DIV



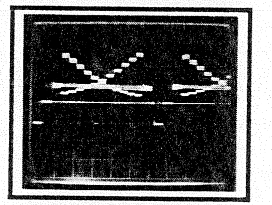
8. 10μsec/DIV, 0.1V/DIV



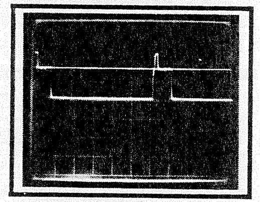
9. 10μsec/DIV, 1V/DIV



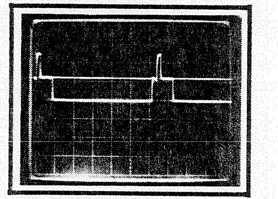
10. 10μsec/DIV, 0.5V/DIV



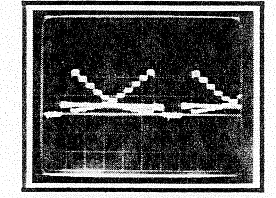
11. 10μsec/DIV, 0.2V/DIV



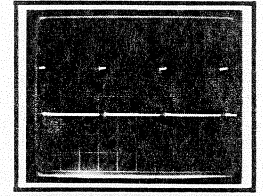
12. 10μsec/DIV, 0.2V/DIV



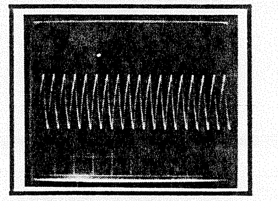
13. 10μsec/DIV, 0.1V/DIV



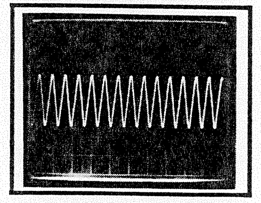
14. 20μsec/DIV, 2V/DIV



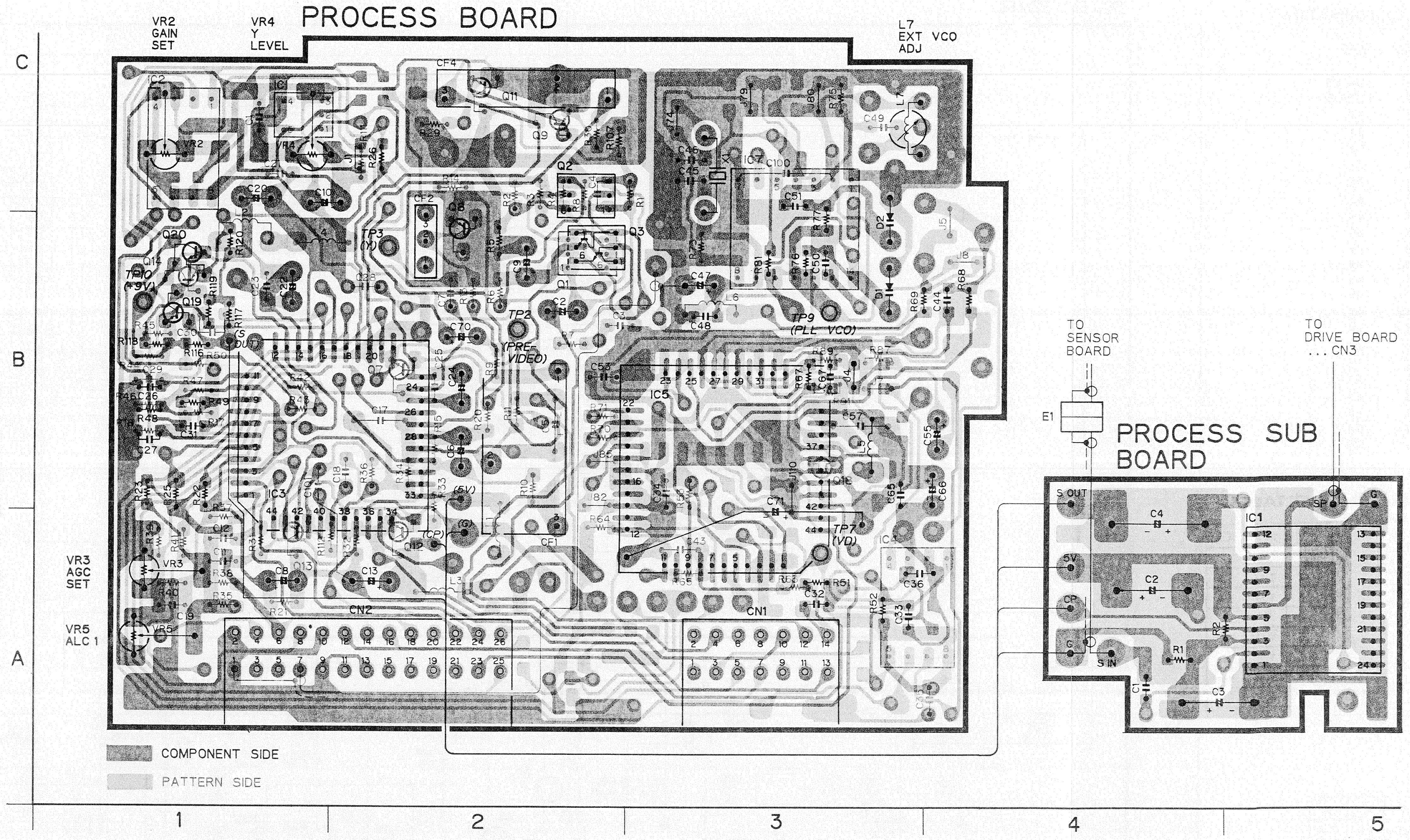
15. 0.5μsec/DIV, 1V/DIV



16. 0.1μsec/DIV, 1V/DIV



CONDUCTOR VIEW OF PROCESS BOARD


PROCESS BOARD
VR2 GAIN SET
VR4 Y LEVEL
L7 EXT VCO ADJ
VR3 AGC SET
VR5 ALC 1
TP10 (+9V)
TP3 (Y)
TP2 (PRE-VIDEO)
TP9 (PLL VCO)
TP7 (VD)
(5V)
(G)
(TCP)
(S OUT)
IC2
IC1
IC3
IC4
IC5
IC7
Q1
Q2
Q3
Q7
Q8
Q9
Q11
Q12
Q13
Q14
Q18
Q19
Q20
D1
D2
CN1
CN2
CF1
CF2
CF4
L7
TO SENSOR BOARD
TO DRIVE BOARD ... CN3
E1
PROCESS SUB BOARD
S OUT
5V
CP
G
S IN
SP
C1
C2
C3
C4
R1
R2
COMPONENT SIDE
PATTERN SIDE
A
B
C
1
2
3
4
5

<ADDRESS INFORMATION>

PROCESS BOARD

IC1	C1
IC2	C1
IC3	B1,B2
IC4	A3
IC5	A3,B3
IC7	B3,C3
Q1	B2
Q2	C2
Q3	B2
Q7	B2
Q8	B2
Q9	C2
Q11	C2
Q12	A2
Q13	A1
Q14	B1
Q18	B3
Q19	B1
Q20	B1
D1	B3
D2	B3

PROCESS SUB BOARD

IC1	A5

SCHEMATIC DIAGRAM OF DC/DC BOARD

<ADDRESS INFORMATION>

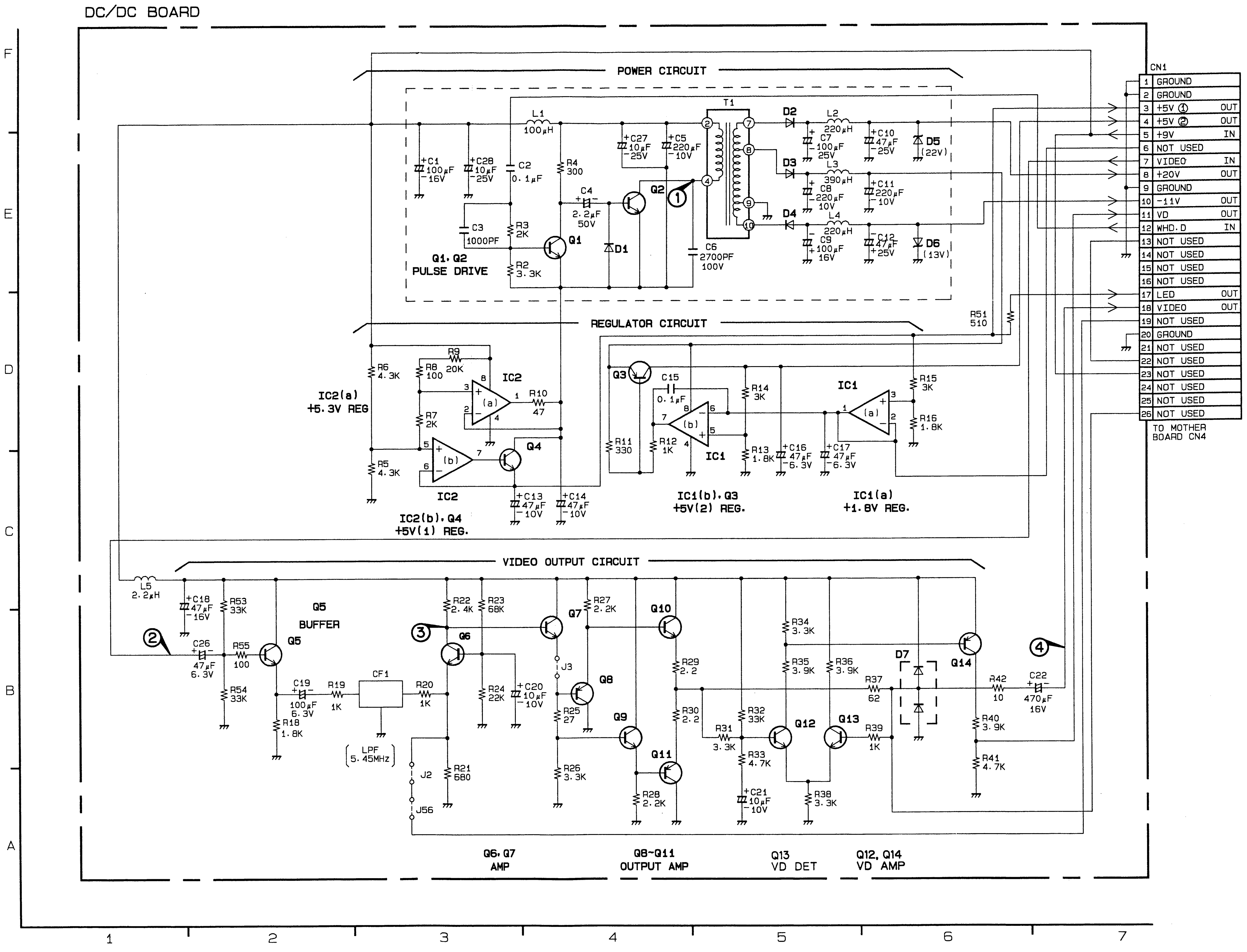
DC/DC BOARD

IC1	D4, D5
IC2	C3, D3
Q1	E4
Q2	E4
Q3	D4
Q4	C3
Q5	B2
Q6	B3
Q7	B4
Q8	B4
Q9	B4
Q10	B4
Q11	B4
Q12	B5
Q13	B5
Q14	B6
D1	E4
D2	F5
D3	E5
D4	E5
D5	E6
D6	E6
D7	B6

<VOLTAGES>

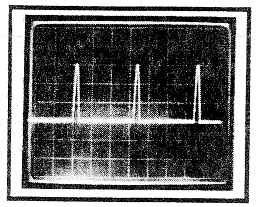
	IC1	IC2
Pin 1	1.9	3.7
2	1.9	5.4
3	1.9	5.4
4	0	0
5	1.9	5.0
6	1.9	5.0
7	3.6	5.7
8	6.3	9.2

	B	C	E
Q1	5.0	7.0	5.4
Q2	5.4	8.9	5.9
Q3	5.7	5.0	6.3
Q4	5.7	5.4	5.0
Q5	4.5	9.2	3.8
Q6	2.0	4.9	1.2
Q7	4.9	9.2	4.3
Q8	4.3	0	4.9
Q9	4.2	9.2	3.6
Q10	4.9	9.2	4.3
Q11	3.6	0	4.3
Q12	4.9	4.3	4.2
Q13	4.3	9.2	4.2
Q14	8.5	9.2	9.2

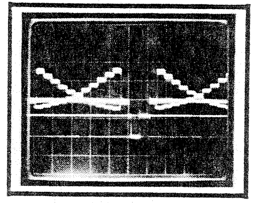

DC/DC BOARD
POWER CIRCUIT
REGULATOR CIRCUIT
VIDEO OUTPUT CIRCUIT
Q1, Q2 PULSE DRIVE
IC2(a) +5.3V REG
IC2(b), Q4 +5V(1) REG.
IC1(b), Q3 +5V(2) REG.
IC1(a) +1.8V REG.
Q5 BUFFER
Q6, Q7 AMP
Q8-Q11 OUTPUT AMP
Q13 VD DET
Q12, Q14 VD AMP
LPF 5.45MHz
CF1
T1
L1 100μH
L2 220μH
L3 390μH
L4 220μH
L5 2.2μH
D5 (22V)
D6 (13V)
R51 510
CN1
1 GROUND
2 GROUND
3 +5V ① OUT
4 +5V ② OUT
5 +9V IN
6 NOT USED
7 VIDEO IN
8 +20V OUT
9 GROUND
10 -11V OUT
11 VD OUT
12 WHD.D IN
13 NOT USED
14 NOT USED
15 NOT USED
16 NOT USED
17 LED OUT
18 VIDEO OUT
19 NOT USED
20 GROUND
21 NOT USED
22 NOT USED
23 NOT USED
24 NOT USED
25 NOT USED
26 NOT USED
TO MOTHER BOARD CN4
F
E
D
C
B
A
1
2
3
4
5
6
7

CONDUCTOR VIEW OF DC/DC BOARD

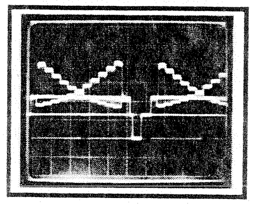
DC/DC Board



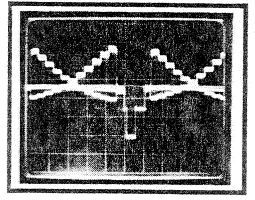
1. 20µsec/DIV, 20V/DIV



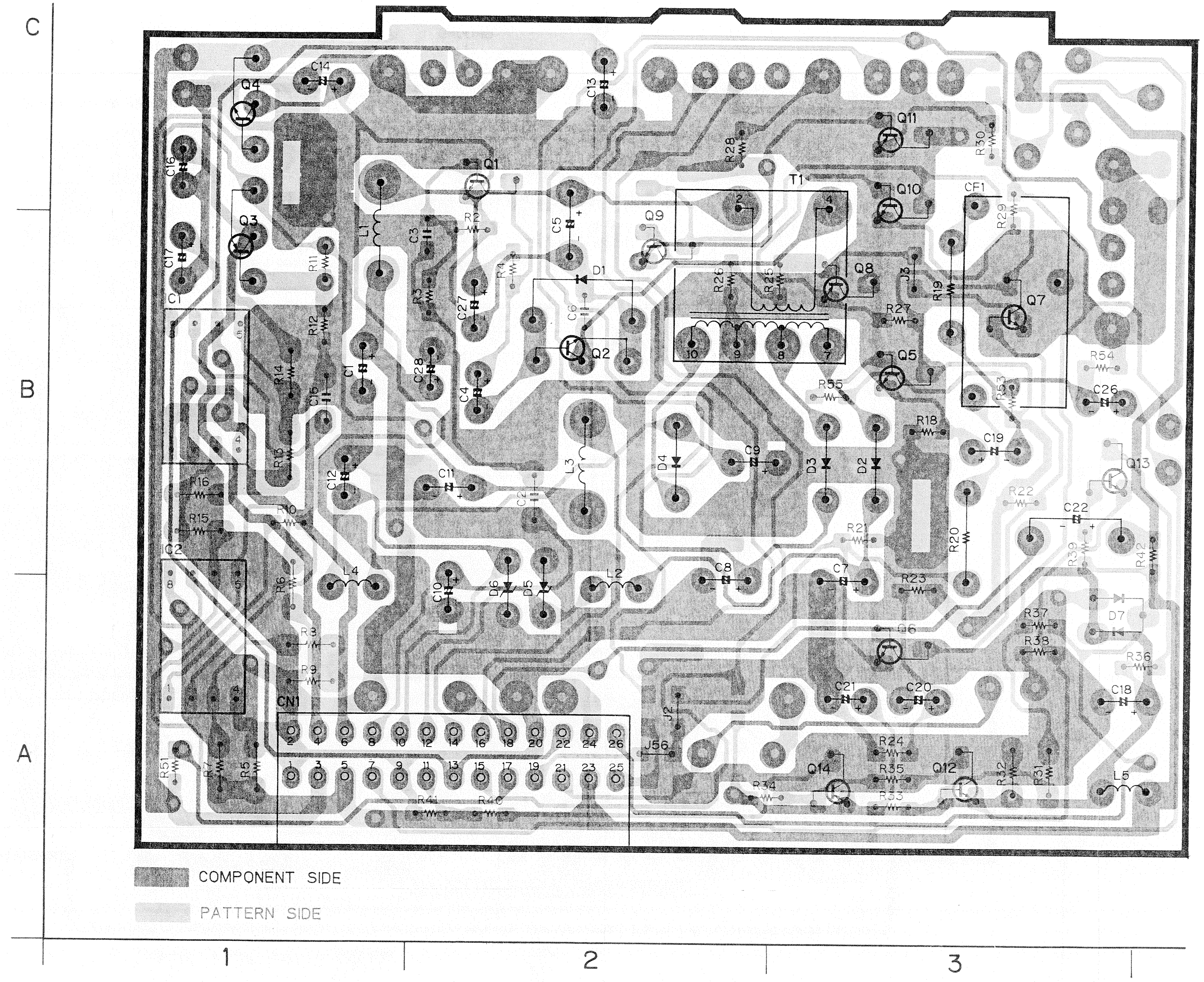
2. 10µsec/DIV, 0.5V/DIV



3. 10µsec/DIV, 0.5V/DIV



4. 10µsec/DIV, 0.2V/DIV


C
B
A
1
2
3
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
T1
CF1
CN1
L1
L2
L3
L4
L5
D1
D2
D3
D4
D5
D6
D7
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
C22
C26
C27
C28
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R38
R39
R40
R41
R42
R51
R53
R54
R55
J5
J2
J56
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26

▨ COMPONENT SIDE

▨ PATTERN SIDE

<ADDRESS INFORMATION>

DC/DC BOARD

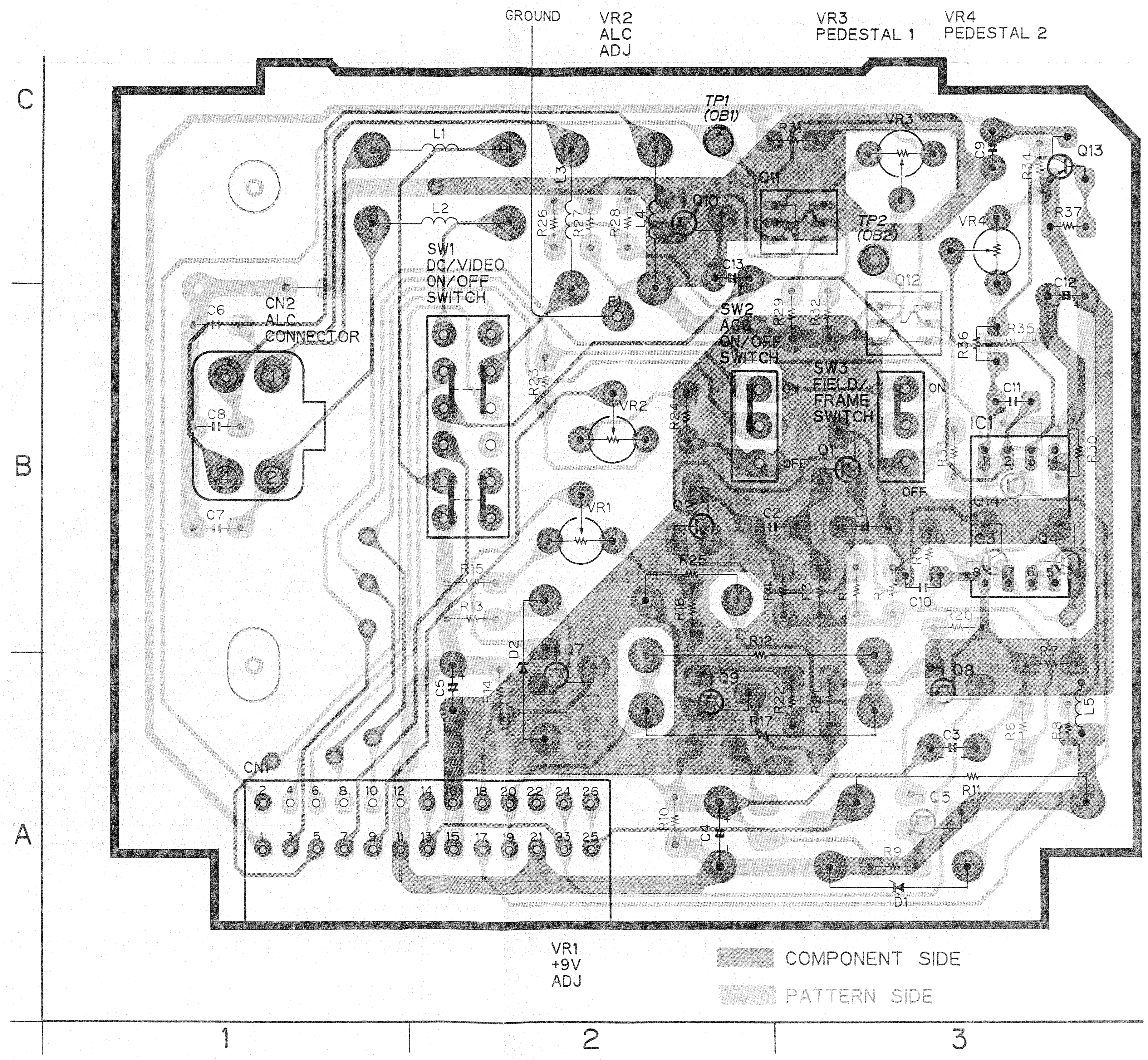
IC1	B1
IC2	A1
Q1	C2
Q2	B2
Q3	B1
Q4	C1
Q5	B3
Q6	A3
Q7	B3
Q8	B3
Q9	B2
Q10	C3
Q11	C3
Q12	A3
Q13	B3
Q14	A3
D1	B2
D2	B3
D3	B3
D4	B2
D5	A2
D6	A2
D7	A3

CONDUCTOR VIEW OF CONTROL BOARD

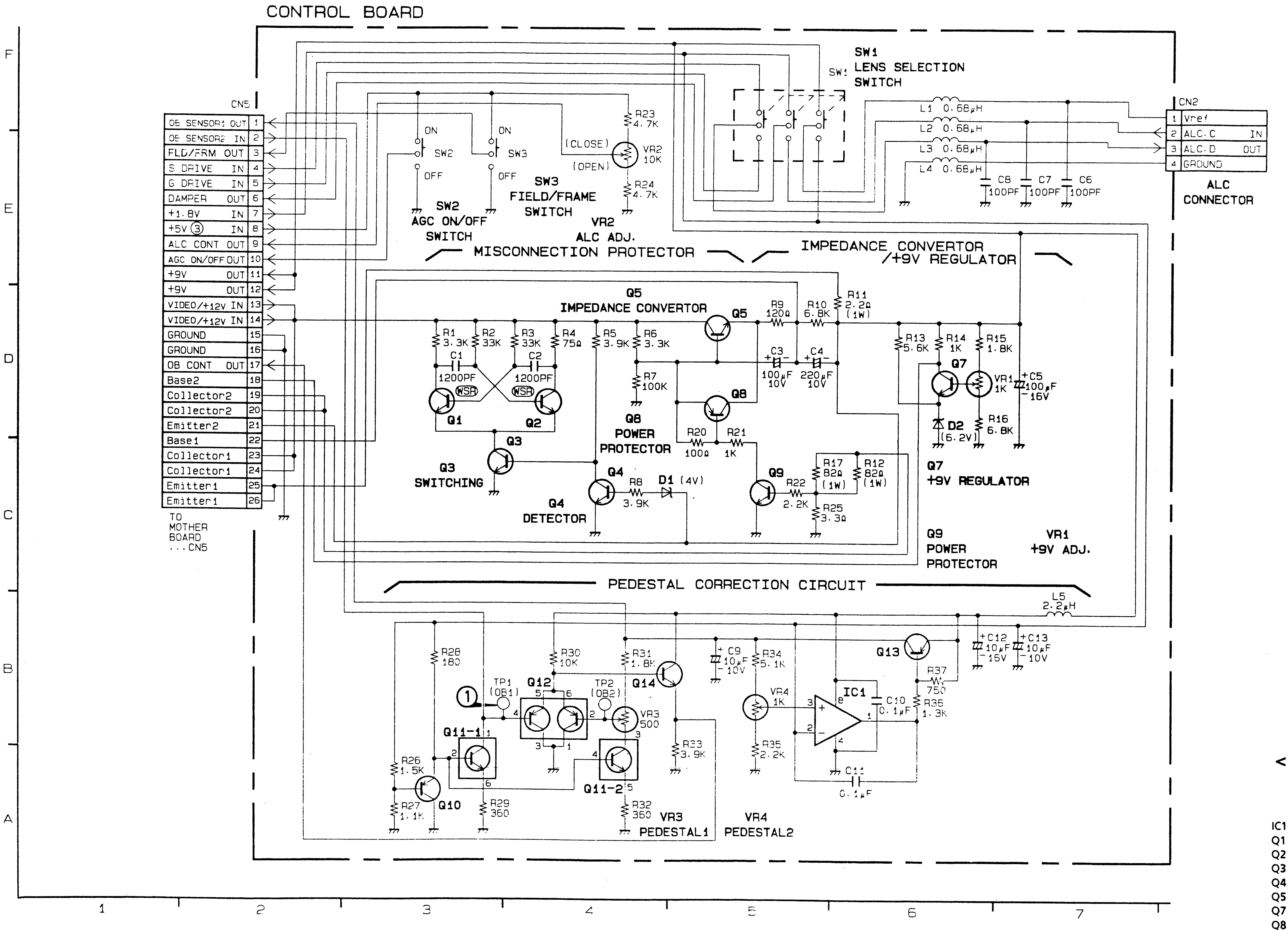
<ADDRESS INFORMATION>

CONTROL BOARD

IC1	B3
Q1	B3
Q2	B2
Q3	B3
Q4	B3
Q5	A3
Q7	A2
Q8	A3
Q9	A2
Q10	C2
Q11	C2, C3
Q12	B3
Q13	C3
Q14	B3
D1	A3
D2	A2, B2

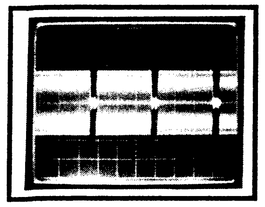

GROUND
VR2
ALC
ADJ
VR3
PEDESTAL 1
VR4
PEDESTAL 2
C
B
A
TP1
(OB1)
TP2
(OB2)
L1
L2
L3
L4
L5
Q10
Q11
Q12
Q13
Q14
Q1
Q2
Q3
Q4
Q5
Q7
Q8
Q9
VR1
VR2
VR3
VR4
IC1
SW1
DC/VIDEO
ON/OFF
SWITCH
CN2
ALC
CONNECTOR
SW2
AGC
ON/OFF
SWITCH
SW3
FIELD/
FRAME
SWITCH
ON
OFF
E1
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
R1
R3
R4
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
D1
D2
CN1
2 4 6 8 10 12 14 16 18 20 22 24 26
1 3 5 7 9 11 13 15 17 19 21 23 25
VR1
+9V
ADJ
COMPONENT SIDE
PATTERN SIDE
1
2
3

SCHEMATIC DIAGRAM OF CONTROL BOARD


CONTROL BOARD
CN5
OB SENSOR1 OUT 1
OB SENSOR2 IN 2
FLD/FRM OUT 3
S DRIVE IN 4
G DRIVE IN 5
DAMPER OUT 6
+1.8V IN 7
+5V ③ IN 8
ALC CONT OUT 9
AGC ON/OFF OUT 10
+9V OUT 11
+9V OUT 12
VIDEO/+12V IN 13
VIDEO/+12V IN 14
GROUND 15
GROUND 16
OB CONT OUT 17
Base2 18
Collector2 19
Collector2 20
Emitter2 21
Base1 22
Collector1 23
Collector1 24
Emitter1 25
Emitter1 26
TO MOTHER BOARD ...CN5
SW2 AGC ON/OFF SWITCH
ON
OFF
SW3 FIELD/FRAME SWITCH
R23 4.7K
VR2 10K
(CLOSE)
(OPEN)
R24 4.7K
VR2 ALC ADJ.
SW1 LENS SELECTION SWITCH
L1 0.68µH
L2 0.68µH
L3 0.68µH
L4 0.68µH
C8 100PF
C7 100PF
C6 100PF
CN2
1 Vref
2 ALC.C IN
3 ALC.D OUT
4 GROUND
ALC CONNECTOR
MISCONNECTION PROTECTOR
IMPEDANCE CONVERTOR /+9V REGULATOR
Q5 IMPEDANCE CONVERTOR
R1 3.3K
R2 33K
R3 33K
R4 75Ω
R5 3.9K
R6 3.3K
C1 1200PF
C2 1200PF
WSR
Q1
Q2
Q3
Q3 SWITCHING
R7 100K
Q8 POWER PROTECTOR
R9 120Ω
R10 6.8K
R11 2.2Ω (1W)
C3 100µF 10V
C4 220µF 10V
R20 100Ω
R21 1K
Q4 DETECTOR
R8 3.9K
D1 (4V)
Q9
R17 82Ω (1W)
R12 82Ω (1W)
R22 2.2K
R25 3.3Ω
R13 5.6K
R14 1K
R15 1.8K
Q7
VR1 1K
C5 100µF 16V
D2 (6.2V)
R16 6.8K
Q7 +9V REGULATOR
Q9 POWER PROTECTOR
VR1 +9V ADJ.
PEDESTAL CORRECTION CIRCUIT
L5 2.2µH
R28 180
R30 10K
R31 1.8K
Q14
C9 10µF 10V
R34 5.1K
Q13
C12 10µF 16V
C13 10µF 10V
R37 750
TP1 (OB1)
TP2 (OB2)
Q12
VR3 500
VR4 1K
IC1
C10 0.1µF
R36 1.3K
Q11-1
Q11-2
R26 1.5K
R27 1.1K
Q10
R29 360
R32 360
R33 3.9K
R35 2.2K
C11 0.1µF
VR3 PEDESTAL1
VR4 PEDESTAL2
F
E
D
C
B
A
1
2
3
4
5
6
7

Control Board

1. 20µsec/DIV, 0.05V/DIV



<VOLTAGES>

	Q11	Q12
Pin 1	0	0
2	1.4	1.8
3	0	0
4	1.4	2.0
5	0.8	2.4
6	0.8	2.4

	B	C	E
Q1	12.7	12.7	12.4
Q2	12.7	12.7	12.4
Q3	0	12.4	0
Q4	0.7	0	0
Q5	11.3	12.8	10.7
Q6	9.8	10.6	10.6
Q7	6.9	8.5	6.4
Q8	11.3	10.7	11.3
Q9	0.4	10.9	0
Q10	0.8	0	1.4
Q13	0	8.5	0
Q14	0	2.4	1.8

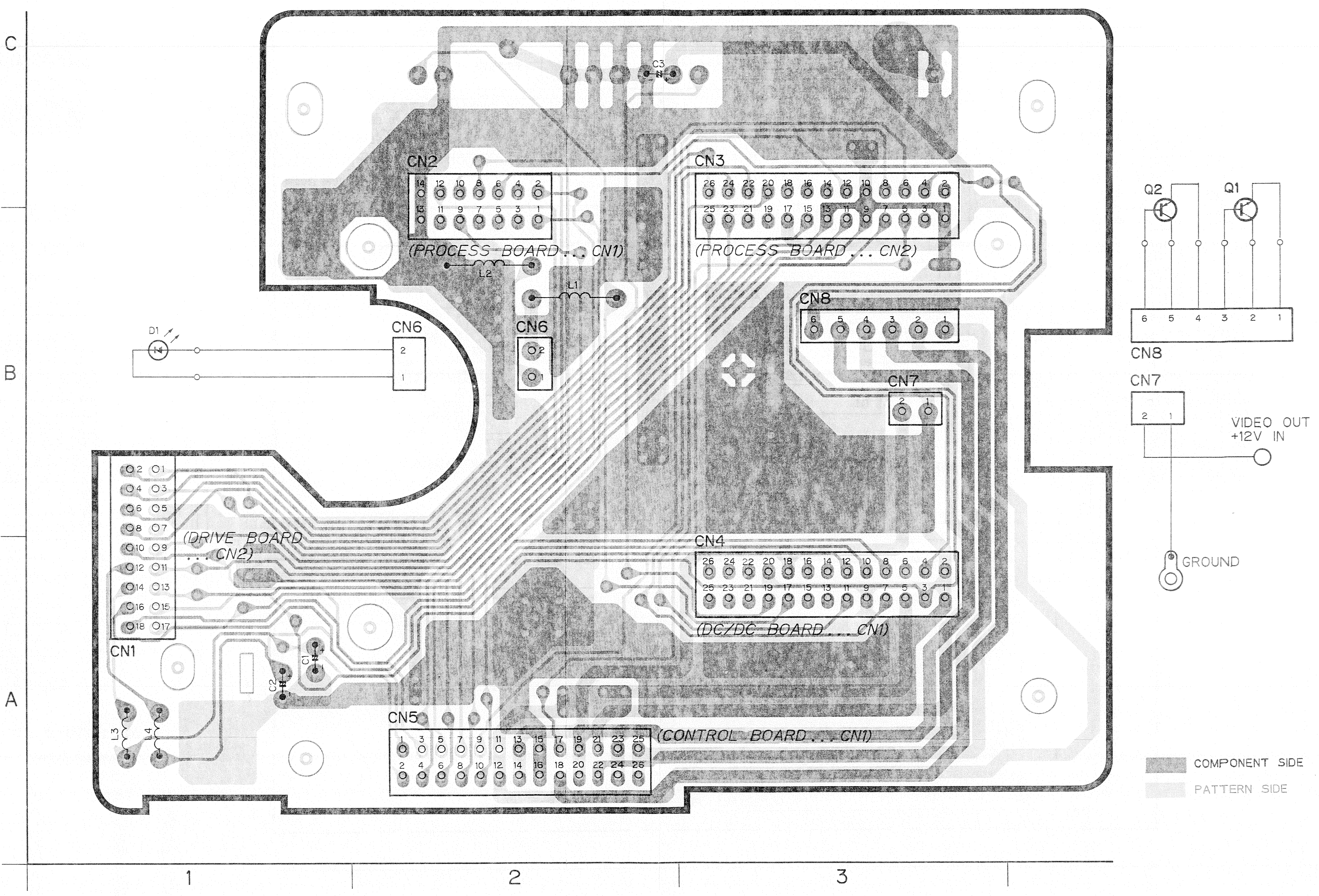
	IC1
Pin 1	0
2	1.8
3	0
4	0
5	1.5
6	1.4
7	8.8
8	9.2

<ADDRESS INFORMATION>

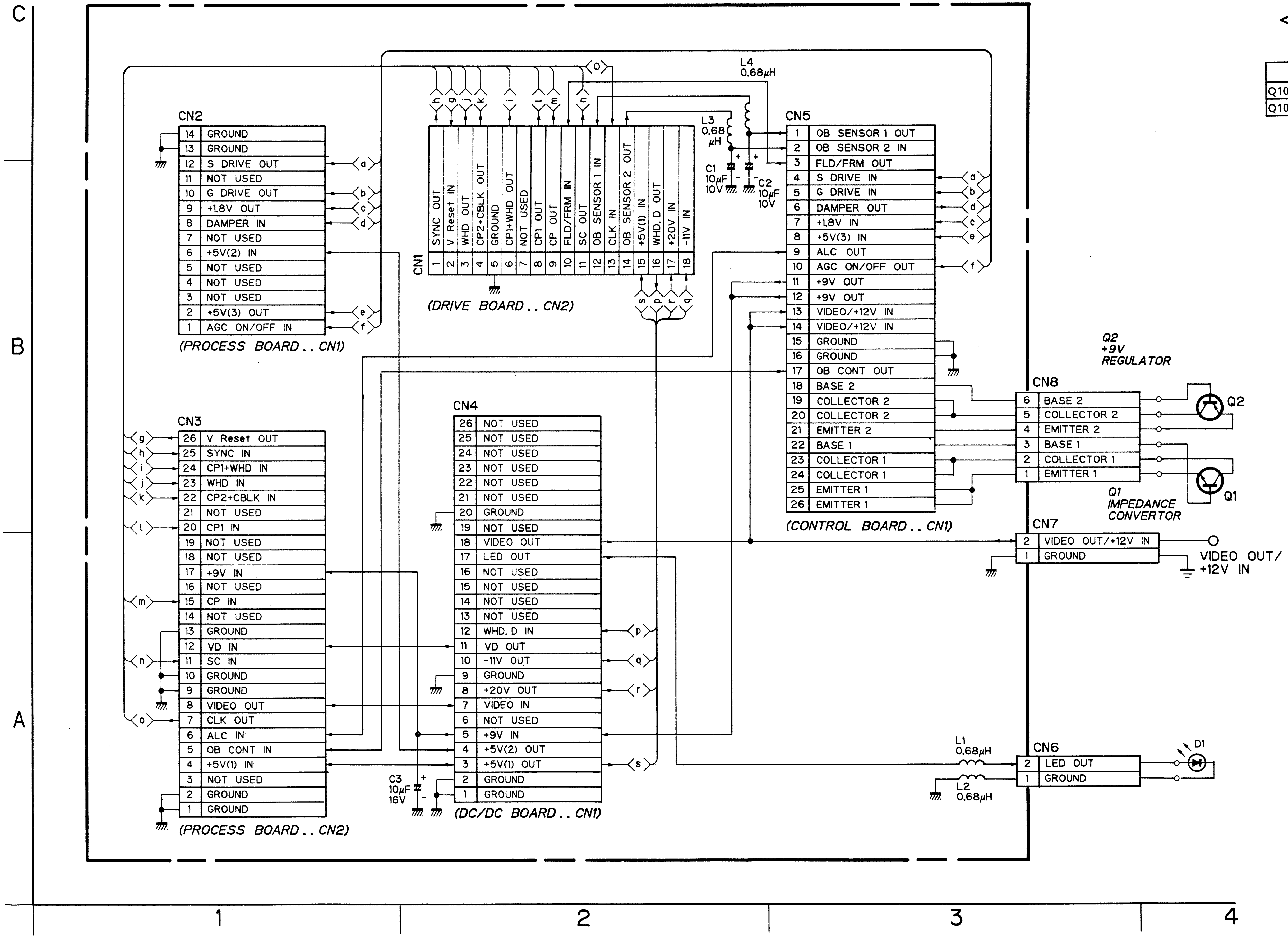
CONTROL BOARD

IC1	B5, B6	Q9	C5
Q1	D3	Q10	A3
Q2	D4	Q11	A3, A4
Q3	C4	Q12	B4
Q4	C4	Q13	B6
Q5	D5	Q14	B4
Q7	D6	D1	C4
Q8	D5	D2	D6

CONDUCTOR VIEW OF MOTHER BOARD


C
B
A
1
2
3
C3
CN2
(PROCESS BOARD ... CN1)
CN3
(PROCESS BOARD ... CN2)
L2
L1
D1
CN6
CN8
CN7
CN1
(DRIVE BOARD ... CN2)
CN4
(DC/DC BOARD ... CN1)
C1
C2
L3
L4
CN5
(CONTROL BOARD ... CN1)
Q2
Q1
VIDEO OUT
+12V IN
GROUND
COMPONENT SIDE
PATTERN SIDE

SCHEMATIC DIAGRAM OF MOTHER BOARD


C
B
A
1
2
3
4
CN2
14 GROUND
13 GROUND
12 S DRIVE OUT
11 NOT USED
10 G DRIVE OUT
9 +1.8V OUT
8 DAMPER IN
7 NOT USED
6 +5V(2) IN
5 NOT USED
4 NOT USED
3 NOT USED
2 +5V(3) OUT
1 AGC ON/OFF IN
(PROCESS BOARD.. CN1)
CN1
1 SYNC OUT
2 V Reset IN
3 WHD OUT
4 CP2+CBLK OUT
5 GROUND
6 CP1+WHD OUT
7 NOT USED
8 CP1 OUT
9 CP OUT
10 FLD/FRM IN
11 SC OUT
12 OB SENSOR 1 IN
13 CLK IN
14 OB SENSOR 2 OUT
15 +5V(1) IN
16 WHD. D OUT
17 +20V IN
18 -11V IN
(DRIVE BOARD.. CN2)
L4
0.68μH
L3
0.68
μH
C1
10μF
10V
C2
10μF
10V
CN5
1 OB SENSOR 1 OUT
2 OB SENSOR 2 IN
3 FLD/FRM OUT
4 S DRIVE IN
5 G DRIVE IN
6 DAMPER OUT
7 +1.8V IN
8 +5V(3) IN
9 ALC OUT
10 AGC ON/OFF OUT
11 +9V OUT
12 +9V OUT
13 VIDEO/+12V IN
14 VIDEO/+12V IN
15 GROUND
16 GROUND
17 OB CONT OUT
18 BASE 2
19 COLLECTOR 2
20 COLLECTOR 2
21 EMITTER 2
22 BASE 1
23 COLLECTOR 1
24 COLLECTOR 1
25 EMITTER 1
26 EMITTER 1
(CONTROL BOARD.. CN1)
Q2
+9V
REGULATOR
CN8
6 BASE 2
5 COLLECTOR 2
4 EMITTER 2
3 BASE 1
2 COLLECTOR 1
1 EMITTER 1
Q2
Q1
Q1
IMPEDANCE
CONVERTOR
CN7
2 VIDEO OUT/+12V IN
1 GROUND
VIDEO OUT/
+12V IN
CN3
26 V Reset OUT
25 SYNC IN
24 CP1+WHD IN
23 WHD IN
22 CP2+CBLK IN
21 NOT USED
20 CP1 IN
19 NOT USED
18 NOT USED
17 +9V IN
16 NOT USED
15 CP IN
14 NOT USED
13 GROUND
12 VD IN
11 SC IN
10 GROUND
9 GROUND
8 VIDEO OUT
7 CLK OUT
6 ALC IN
5 OB CONT IN
4 +5V(1) IN
3 NOT USED
2 GROUND
1 GROUND
(PROCESS BOARD.. CN2)
CN4
26 NOT USED
25 NOT USED
24 NOT USED
23 NOT USED
22 NOT USED
21 NOT USED
20 GROUND
19 NOT USED
18 VIDEO OUT
17 LED OUT
16 NOT USED
15 NOT USED
14 NOT USED
13 NOT USED
12 WHD. D IN
11 VD OUT
10 -11V OUT
9 GROUND
8 +20V OUT
7 VIDEO IN
6 NOT USED
5 +9V IN
4 +5V(2) OUT
3 +5V(1) OUT
2 GROUND
1 GROUND
(DC/DC BOARD.. CN1)
C3
10μF
16V
L1
0.68μH
L2
0.68μH
CN6
2 LED OUT
1 GROUND
D1
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s

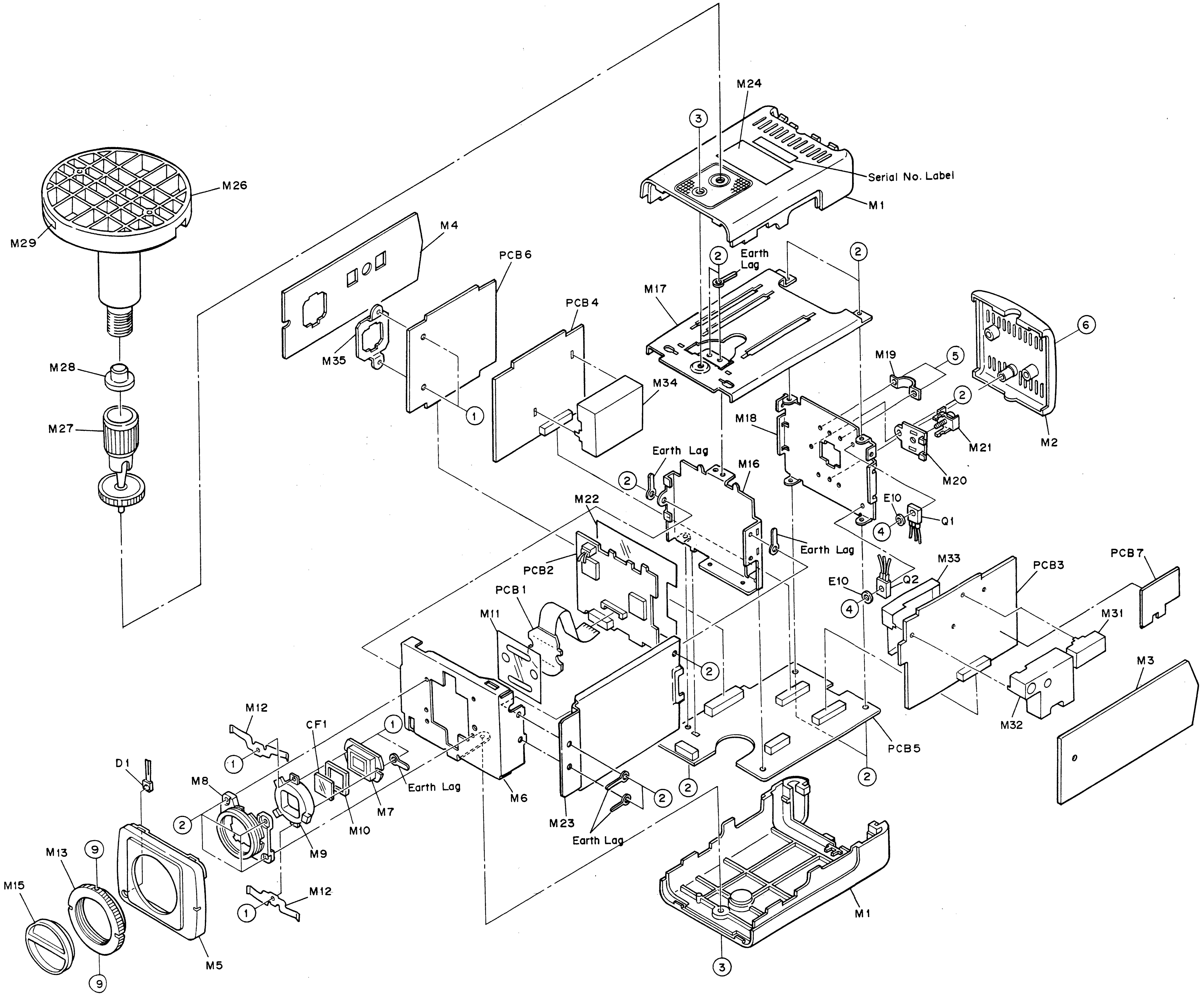
<VOLTAGES>

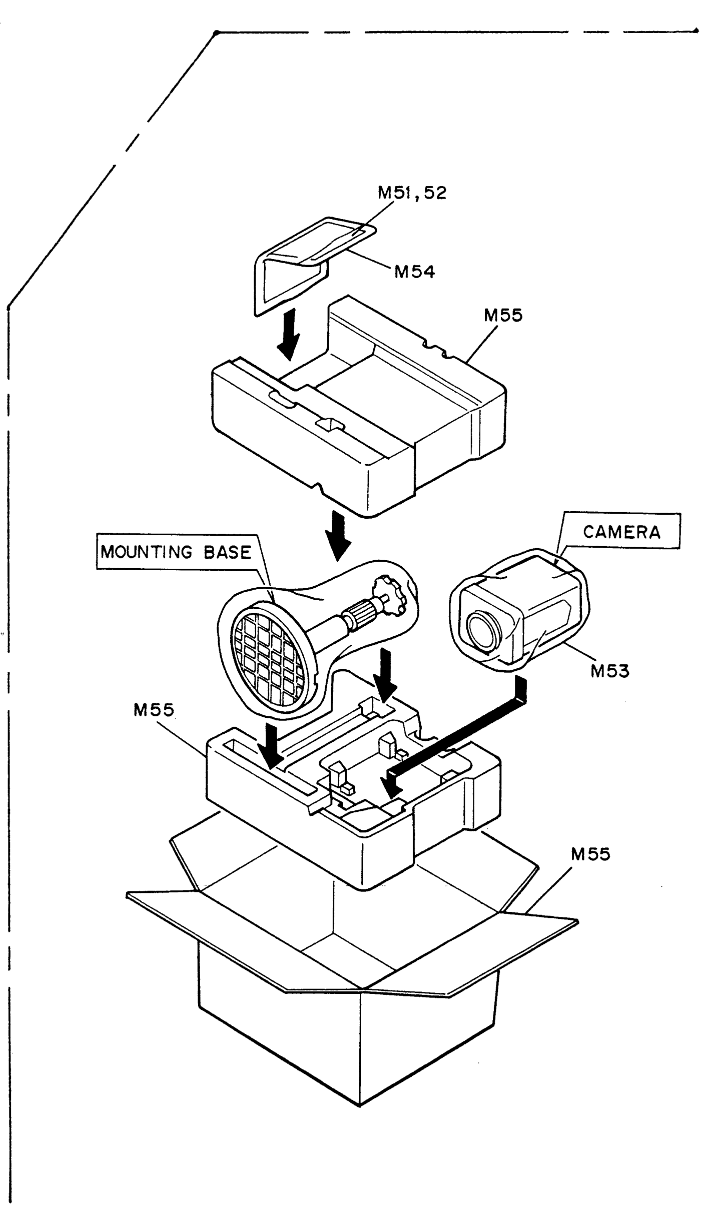
	B	C	E
Q101	10.4	12.3	9.6
Q102	8.5	1.1	9.2

EXPLODED VIEW OF WV-BL90

○Numbers show screws.

No.	Screws	Description
①	XSB2+4FX	Binding Head Screws
②	XSB26+5FX	Binding Head Screws
③	XSB26+5FN	Binding Head Screws
④	XSB3+6FX	Binding Head Screws
⑤	XSB3+8FN	Binding Head Screws
⑥	XSB3+12FN	Binding Head Screws
⑦	XSB26+4FXV	Binding Head Viyolet Screws
⑧	XSB26+6FXK	Binding Head Black Screws
⑨	XSN2+8FXK	Pan Head Black Screws


M24
③
Serial No. Label
M1
M26
M29
M4
PCB6
PCB4
M17
② Earth Lag
②
⑥
M2
M28
M35
①
M34
M19
⑤
②
M21
M27
M18
M20
Earth Lag
②
M16
E10
Q1
④
M22
Earth Lag
PCB2
PCB1
E10
④
Q2
M33
PCB3
PCB7
M11
②
M31
M3
M32
M12
CF1
①
PCB5
D1
M8
①
Earth Lag
M7
M6
②
②
②
②
M10
M23
M9
Earth Lag
M13
⑨
M15
M5
M12
①
⑨
M1
③


M51,52
M54
M55
MOUNTING BASE
CAMERA
M53
M55
M55

REPLACEMENT PARTS LIST

Important Notice

1. Components identified by "⚠" mark have special characteristics important for safety.
   When replacing any of these components, use only manufacturer's specified parts.
2. Printed circuit board assembly with mark (NLA) is no longer available after production discontinuation of the complete set.

MISCELLANEOUS

REF.NO.	PART NO.	DESCRIPTION
Q1	2SC1568-ST	Transistor
Q2	2SA886-QR	Transistor
D1	LN25RCP	Diode
CF1	YWIRC730X18	Filter
E10	YFN074A	Insulator Washer for Transistor
M1	YWV5KC0057A2	Case
M2	YFV5EB0283A3	Rear Cover
M3	YWV7QD1807A4	Right Side Namer for WV-BL90E
	YWV7QE1807A4	Right Side Namer for WV-BL90F
M4	YWV7QE1808A4	Left Side Namer for WV-BL90E
	YWV7QF1808A4	Left Side Namer for WV-BL90F
M5	YFV5BA0020B3	Front Escutcheon
M6	YWV2KA0535A3	Front Chassis
M7	YWV9BA0013AN	Optical Ass'y
M8	YFV2TA0060A4	Mounting Bracket
M9	YWV6FA0092A4	Bracket
M10	YWV2FA0401A4	Cushion
M11	YWV2PA0312A4	Insulator
M12	YFV4JA0088B4	Spring
M13	YWV3FA0106A4	Ring
M15	YWBC-2B	Body Cap
M16	YWV2SA1465A3	Main Mounting Angle
M17	YWV2SA1452A3	Upper Mounting Angle
M18	YWV2SA1353A3	Rear Chassis
M19	YFV2GA0008A4	Cord Clamp
M20	YFV2PA0087A4	Insulator
M21	YVL467GTM049	Electrode
M22	YWV2PA0313A4	Insulator
M23	YWV2HA0736A4	Shield Plate
M24 ⚠	YFV7MB0099A4	Safety Label for WV-BL90E
	YFV7MB0106A4	Safety Labelfor WV-BL90F
M26	YF118C-097	Mounting Base
M27	YF118B-004	Camera Mounting Bracket Assy
M28	YF118C-051	Camera Mount Nuts
M29	YWV7QA1162A4	Base Label for WV-BL90E
	YWV7QA1264A4	Base Label for WV-BL90F

SENSOR BOARD

REF.NO.	PART NO.	DESCRIPTION
PCB1 (NLA)	YWVKYBL90P1A	PrintedCircuit Board Assy
Q1	2SC3931-CD	Transistor
R2	ERJ3GEYJ330	Metal 33 ohms 1/16W
R5,6	ERJ3GEYJ101	Carbon 100 ohms 1/16W
R7	ERJ3GEYJ222	Metal 2.2K ohms 1/16W
R8-11	ERJ3GEYJ330	Metal 33 ohms 1/16W
C1	YF426682XKT	Ceramic 6800 pF 50V
C2	ECST1VC225	Electrolytic 2.2 µF 35V
C3-5	YF426104XKS	Ceramic 0.1 µF
J1	ERJ3GEY0R00	Jumper Resistor
J3,4	ERJ3GEY0R00	Jumper Resistor

DRIVE BOARD

REF.NO.	PART NO.	DESCRIPTION
PCB2 (NLA)	YWVKYBL90E2A	Printed Circuit Board Assy
IC1	YWUPD6147G	IC
IC2	MN74HCU04S	IC
IC3	YWTC6003F	IC
IC4	YWTC6013U	IC
IC5	YWTC4S69F	IC
Q1	2SD1819-QRS	Transistor
Q2	2SB1218-QRS	Transistor
Q5	2SD1819-QRS	Transistor
Q6	2SK662-PQR	FET
Q7	2SD1819-QRS	Transistor
Q8	2SB1218-QRS	Transistor
Q9	2SD1819-QRS	Transistor
D1,2	1SV153	Diode
R1	ERJ3GEYJ222	Metal 2.2K ohms 1/16W
R2	ERJ3GEYJ123	Metal 12K ohms 1/16W
R3	ERJ3GEYJ752	Metal 7.5K ohms 1/16W
R4	ERJ3GEYJ332	Metal 3.3K ohms 1/16W
R5,6	ERJ3GEYJ104	Metal 100K ohms 1/16W
R13	ERJ3GEYJ104	Metal 100K ohms 1/16W
R15	ERJ3GEYJ303	Metal 30K ohms 1/16W
R16	ERJ3GEYJ103	Metal 10K ohms 1/16W
R17	ERJ3GEYJ202	Metal 2K ohms 1/16W
R18	ERJ3GEYJ163	Metal 16K ohms 1/16W
R19	ERJ3GEYJ432	Metal 4.3K ohms 1/16W
R20	ERJ3GEYJ103	Metal 10K ohms 1/16W
R21	ERJ3GEYJ221	Metal 220 ohms 1/16W
R22	ERJ3GEYJ105	Metal 1M ohms 1/16W
R23	ERJ3GEYJ103	Metal 10K ohms 1/16W
R24	ERJ3GEYJ562	Metal 5.6K ohms 1/16W

REF.NO.	PART NO.	DESCRIPTION
R25	ERJ3GEYJ102	Metal 1K ohms 1/16W
R26	ERJ3GEYJ103	Metal 10K ohms 1/16W
R27	ERJ3GEYJ471	Metal 470 ohms 1/16W
R28	ERJ3GEYJ271	Metal 270 ohms 1/16W
R31	ERJ3GEYJ105	Metal 1M ohms 1/16W
R34	ERJ3GEYJ221	Metal 220 ohms 1/16W
R41	ERJ3GEYJ562	Metal 5.6K ohms 1/16W
R42	ERJ3GEYJ103	Metal 10K ohms 1/16W
R45	ERJ3GEYJ561	Metal 560 ohms 1/16W
R46,47	ERJ3GEYJ562	Metal 5.6K ohms 1/16W
R48,49	ERJ3GEYJ561	Metal 560 ohms 1/16W
R51	ERJ3GEYJ562	Metal 5.6K ohms 1/16W
R52	ERJ3GEYJ561	Metal 560 ohms 1/16W
R53	ERJ3GEYJ272	Metal 2.7K ohms 1/16W
R54	ERJ3GEYJ561	Metal 560 ohms 1/16W
R57	ERJ3GEYJ103	Metal 10K ohms 1/16W
R59	ERJ3GEYJ221	Metal 220 ohms 1/16W
R60	ERJ3GEYJ751	Metal 750 ohms 1/16W
R61,62	ERJ3GEYJ561	Metal 560 ohms 1/16W
R64,65	ERJ3GEYJ820	Metal 82 ohms 1/16W
R66	ERJ3GEYJ330	Metal 33 ohms 1/16W
VR1	EVML1GA00B15	Variable Resistor 100K ohms
VR2	EVML1GA00B53	Variable Resistor 5K ohms
C1	ECEA1EKS100	Electrolytic 10 µF 25V
C2	ECEA1CK220	Electrolytic 22 µF 16V
C3,4	ECEA1AKS330	Electrolytic 33 µF 10V
C7	ECEA1CK220	Electrolytic 22 µF 16V
C10	ECEA1HKS010	Electrolytic 1 µF 50V
C12,14	YF400331CHJT	Ceramic 330 pF
C15	YW5X103K2VB	Ceramic 0.01 µF
C16	ECST1AC106ZR	Tantalum 10 µF 10V
C17	YW5X472K2VB	Ceramic 4700 pF
C18	ECEA1HKK2R2	Electrolytic 2.2 µF 25V
C25	YW5X103K2VB	Ceramic 0.01 µF
C26	ECST1AC106ZR	Tantalum 10 µF 10V
C27	YW5X103K2VB	Ceramic 0.01 µF
C30	ECST1AC106ZR	Tantalum 10 µF 10V
C31	YW5X103K2VB	Ceramic 0.01 µF
C33	ECST1AC106ZR	Tantalum 10 µF 10V
C34	YW5X103K2VB	Ceramic 0.01 µF
C35	ECST1AC106ZR	Tantalum 10 µF 10V
C36	YW5X103K2VB	Ceramic 0.01 µF
C37	ECEA1HKS010	Electrolytic 1 µF 50V
C40	YW5X103K2VB	Ceramic 0.01 µF
C41	ECST1AC106ZR	Tantalum 10 µF 10V
C44,45	YW5CH470J5VB	Ceramic 47 pF
C46	YW5CH100J5VB	Ceramic 10 pF
C47,50	YW5CH470J5VB	Ceramic 47 pF
C51	YW5CH470J5VB	Ceramic 47 pF
C52	YW5CH100J5VB	Ceramic 10 pF
C53	ECST1AC106ZR	Tantalum 10 µF 10V
C54	YW5X103K2VB	Ceramic 0.01 µF
C55	ECST1ED475	Tantalum 4.7 µF 25V
C57	ECEA1HKS2R2	Electrolytic 2.2 µF 50V
C58	ECEA1EKS100	Electrolytic 10 µF 25V

REF.NO.	PART NO.	DESCRIPTION
C60	ECEA1HKS2R2	Electrolytic 2.2 µF 50V
C63	YW5CH820J5VB	Ceramic 82 pF
C66-68	YW5X103K2VB	Ceramic 0.01 µF
L1	YFF3216A2R2K	Coil 2.2 µH
L2	YWS5LD30426	Coil
L3,4	YFF3216A2R2K	Coil 2.2 µH
L5,6	YWNL322R2K	Coil 2.2 µH
L7,8	YFF3216A2R2K	Coil 2.2 µH
J30,33	ERJ3GEY0R00	Jumper Resistor
J35-39	ERJ3GEY0R00	Jumper Resistor
J63	ERJ3GEY0R00	Jumper Resistor
CN1	YW520301410	14-pin Connector
CN2	YW530201810	18-pin Connector
CN3	EMCS0250Z	2-pin Connector

PROCESS BOARD

REF.NO.	PART NO.	DESCRIPTION
PCB3 (NLA)	YWVKYBL90E3A	Printed Circuit Board Assy
IC1	YWTC4S69F	IC
IC2	MN6287S	IC
IC3	AN2050FB	IC
IC4	BA226AF	IC
IC5	YWPD65012GB	IC
IC7	TC40H000F	IC
Q1	XN6501	Transistor
Q2,3	XN6501	Transistor
Q7	2SD1819-QRS	Transistor
Q8,9	2SB1218-QRS	Transistor
Q11,12	2SD1819-QRS	Transistor
Q13,14	2SB1218-QRS	Transistor
Q18	2SK662-PQR	Fet
Q19	2SC3931-CD	Transistor
Q20	2SD1819-QRS	Transistor
D1,2	1SV153	Diode
R1	ERJ3GEYJ122	Metal 1.2K ohms 1/16W
R2	ERJ3GEYJ391	Metal 390 ohms 1/16W
R3	ERJ3GEYJ163	Metal 16K ohms 1/16W
R4,5	ERJ3GEYJ122	Metal 1.2K ohms 1/16W
R6,7	ERJ3GEYJ562	Metal 5.6K ohms 1/16W
R8	ERJ3GEYJ122	Metal 1.2K ohms 1/16W
R9,10	ERJ3GEYJ102	Metal 1K ohms 1/16W
R11	ERJ3GEYJ122	Metal 1.2K ohms 1/16W
R13	ERJ3GEYJ102	Metal 1K ohms 1/16W
R14	ERJ3GEYJ222	Metal 2.2K ohms 1/16W
R15	ERJ3GEYJ303	Metal 30K ohms 1/16W
R17	ERJ3GEYJ822	Metal 8.2K ohms 1/16W
R18	ERJ3GEYJ182	Metal 1.8K ohms 1/16W
R20	ERJ3GEYJ433	Metal 43K ohms 1/16W
R21	ERJ3GEYJ334	Metal 330K 1/16W
R22	ERJ3GEYJ124	Metal 120K ohms 1/16W
R23	ERJ3GEYJ104	Metal 100K ohms 1/16W
R25	YW2116165JT	Carbon 1.6M ohms 1/16W

REF.NO.	PART NO.	DESCRIPTION
R26	ERJ3GEYJ301	Metal 300 ohms 1/16W
R29	ERJ3GEYJ182	Metal 1.8K ohms 1/16W
R30	ERJ3GEYJ102	Metal 1K ohms 1/16W
R31	ERJ3GEYJ154	Metal 150K ohms 1/16W
R32	ERJ3GEYJ182	Metal 1.8K ohms 1/16W
R33	ERJ3GEYJ222	Metal 2.2K ohms 1/16W
R34	ERJ3GEYJ333	Metal 33K ohms 1/16W
R35	ERJ3GEYJ154	Metal 150K ohms 1/16W
R36	ERJ3GEYJ104	Metal 100K ohms 1/16W
R37	ERJ3GEYJ153	Metal 15K ohms 1/16W
R38	ERJ3GEYJ154	Metal 150K ohms 1/16W
R39	ERJ3GEYJ222	Metal 2.2K ohms 1/16W
R40	ERJ3GEYJ103	Metal 10K ohms 1/16W
R41	ERJ3GEYJ102	Metal 1K ohms 1/16W
R42	ERJ3GEYJ103	Metal 10K ohms 1/16W
R43	ERJ3GEYJ162	Metal 1.6K ohms 1/16W
R44	ERJ3GEYJ622	Metal 6.2K ohms 1/16W
R45	ERJ3GEYJ202	Metal 2K ohms 1/16W
R46	ERJ3GEYJ391	Metal 390 ohms 1/16W
R47	ERJ3GEYJ103	Metal 10K ohms 1/16W
R48	ERJ3GEYJ102	Metal 1K ohms 1/16W
R49	ERJ3GEYJ103	Metal 10K ohms 1/16W
R50	ERJ3GEYJ222	Metal 2.2K ohms 1/16W
R51	ERJ3GEYJ102	Metal 1K ohms 1/16W
R52	ERJ3GEYJ562	Metal 5.6K ohms 1/16W
R53	ERJ3GEYJ103	Metal 10K ohms 1/16W
R63	ERJ3GEYJ472	Metal 4.7K ohms 1/16W
R64	ERJ3GEYJ683	Metal 68K ohms 1/16W
R65	ERJ3GEYJ121	Metal 120 ohms 1/16W
R67	ERJ3GEYJ103	Metal 10K ohms 1/16W
R68	ERJ3GEYJ121	Metal 120 ohms 1/16W
R69	ERJ3GEYJ512	Metal 5.1K ohms 1/16W
R70,71	ERJ3GEYJ102	Metal 1K ohms 1/16W
R73,75	ERJ3GEYJ105	Metal 1M ohms 1/16W
R76,77	ERJ3GEYJ103	Metal 10K ohms 1/16W
R81	ERJ3GEYJ221	Metal 220 ohms 1/16W
R87	ERJ3GEYJ363	Metal 36K ohms 1/16W
R89	ERJ3GEYJ332	Metal 3.3K ohms 1/16W
R91	ERJ3GEYJ392	Metal 3.9K ohms 1/16W
R107	ERJ3GEYJ222	Metal 2.2K ohms 1/16W
R111	ERJ3GEYJ103	Metal 10K ohms 1/16W
R112	ERJ3GEYJ562	Metal 5.6K ohms 1/16W
R116	ERJ3GEYJ223	Metal 22K ohms 1/16W
R117	ERJ3GEYJ472	Metal 4.7K ohms 1/16W
R118	ERJ3GEYJ182	Metal 1.8K ohms 1/16W
R119	ERJ3GEYJ331	Metal 330 ohms 1/16W
R120	ERJ3GEYJ472	Metal 4.7K ohms 1/16W
VR2	EVM13SW00B14	Variable Resistor 10K ohms
VR3	EVM13SW00B15	Variable Resistor 100K ohms
VR4	EVM13SW00B13	Variable Resistor 1K ohms
VR5	EVM13SW00B14	Variable Resistor 10K ohms
C1	YW5F104Z2VB	Ceramic 0.1 µF
C2	ECEA1AKK100	Electrolytic 10 µF 10V
C3	YW5CH101J5VB	Ceramic 100 pF

REF.NO.	PART NO.	DESCRIPTION
C4	YW5F104Z2VB	Ceramic 0.1 µF
C5	ECST1VY334	Tantalum 0.33 µF 35V
C6	ECEA1AKK100	Electrolytic 10 µF 6.3V
C7	YW5F104Z2VB	Ceramic 0.1 µF
C8	ECEA1HS4R7	Electrolytic 4.7 µF 50V
C9	ECEA0GKS470	Electrolytic 47 µF 4V
C10	ECEA1AKS470	Electrolytic 47µF 10V
C11	YW5X222K5VB	Ceramic 2200 pF
C12	YW5F104Z2VB	Ceramic 0.1 µF
C13	ECEA1AS470	Electrolytic 47µF 10V
C17	YF426104XKS	Ceramic 0.1 µF
C18	YW5F104Z2VB	Ceramic 0.1 µF
C19	YW5F473Z2VB	Ceramic 0.047 µF
C20	ECEA0GKS470	Electrolytic 47 µF 4V
C21	YW5F104Z2VB	Ceramic 0.1 µF
C22	ECEA1AKS470	Electrolytic 47 µF 10V
C23	YW5F104Z2VB	Ceramic 0.1 µF
C24	ECEA0JS470	Electrolytic 47 µF 6.3V
C25-31	YW5F104Z2VB	Ceramic 0.1 µF
C32	YW5CH470J5VB	Ceramic 47 PF
C33	YW5F123Z2VB	Ceramic 0.012 µF
C34	YW5CH101J5VB	Ceramic 100 pF
C35	YW5F104Z2VB	Ceramic 0.1 µF
C43	YF400471CHJT	Ceramic 470 PF
C44	YW5CH121J5VB	Ceramic 120 pF
C45,46	YW5CH330J5VB	Ceramic 33 pF
C47	ECSF1CE106	Electrolytic 10 µF 16V
C48	YW5X103K2VB	Ceramic 0.01 µF
C49	YW5F104Z2VB	Ceramic 0.1 µF
C50,51	YW5CH151J5VB	Ceramic 150 pF
C53	YW5F104Z2VB	Ceramic 0.1 µF
C55	ECSF1CE225	Electrolytic 2.2 µF 16V
C57	YWT316B104MT	Ceramic 0.1 µF
C65	YW5X103K2VB	Ceramic 0.01 µF
C66	ECSF1CE106	Electrolytic 10 µF 16V
C67	YW5CH101J5VB	Ceramic 100 pF
C70	ECEA0JKA470	Electrolytic 47µF 6.3V (KA)
C71	ECSF1AE106	Electrolytic 10 µF 10V
C100	ECCF1H220JC	Ceramic 22 pF 50V
C101	ECQM1H333KZ	Plastic 0.033 µF 50V
L1	YWNL322R2K	Coil 2.2 µH
L2,3	YFF3216A2R2K	Coil 2.2 µH
L4	YWNL322R2K	Coil 2.2 µH
L5,6	YFF3216E8R2K	Coil 8.2 µH
L7	YWS5LD30426	Coil
X1	YWHC49US1773	Crystal Oscillator
CF1	YWELB4C015	Filter
CF2	YWELB5B022	Filter
CF4	YWELB4K088	Filter
J1,2	ERJ3GEY0R00	Jumper Resistor
J4,5	ERJ3GEY0R00	Jumper Resistor
J7,8	ERJ3GEY0R00	Jumper Resistor
J74,79	ERJ3GEY0R00	Jumper Resistor

REF.NO.	PART NO.	DESCRIPTION
J80,82	ERJ3GEY0R00	Jumper Resistor
J85,110	ERJ3GEY0R00	Jumper Resistor
CN1	YW530201410	14-pin Connector
CN2	YW530202610	26-pin Connector
M31	YWV2HA0546A4	Shield Parts
M32	YWV2HA0624A4	Shield Parts
M33	YWV2HA0625A4	Shield Parts

DC/DC BOARD

REF.NO.	PART NO.	DESCRIPTION	
PCB4 (NLA)	YWVKYBL90P4A	Printed Circuit Board Assy	
IC1,2	NJM3414M	IC	
Q1	2SD1820-QRS	Transistor	
Q2	2SC3303-0Y	Transistor	
Q3	2SB793-RS	Transistor	
Q4	2SD973-QRS	Transistor	
Q5	2SD1819-QRS	Transistor	
Q6	2SC3931-CD	Transistor	
Q7	2SD1819-QRS	Transistor	
Q8	2SB1218-QRS	Transistor	
Q9,10	2SD1819-QRS	Transistor	
Q11	2SB1218-QRS	Transistor	
Q12,13	2SD1819-QRS	Transistor	
Q14	2SB1218-QRS	Transistor	
D1	MA170	Diode	
D2-4	EU01AV0	Diode	
D5	RD22EB4	Diode	
D6	RD13EB1	Diode	
D7	MA151K	Diode	
R2	ERJ3GEYJ332	Metal	3.3K ohms 1/16W
R3	ERJ3GEYJ202	Metal	2K ohms 1/16W
R4	ERJ3GEYJ301	Metal	300 ohms 1/16W
R5,6	R1220P432D	Metal	4.3K ohms
R7	YWR1220P202D	Metal	2K ohms
R8	YWR1220P101D	Metal	100 ohms
R9	YFR1220P203D	Metal	20K ohms
R10	ERJ3GEYJ470	Metal	47 ohms 1/16W
R11	ERJ3GEYJ331	Metal	330 ohms 1/16W
R12	ERJ3GEYJ102	Metal	1K ohms 1/16W
R13	YWR1220P182D	Metal	1.8K ohms
R14,15	YWR1220P302D	Metal	3K ohms
R16	YWR1220P182D	Metal	1.8K ohms
R18	ERJ3GEYJ182	Metal	1.8K ohms 1/16W
R19,20	ERSA18J102	Solid	1K ohms 1/16W
R21	ERJ3GEYJ681	Metal	680 ohms 1/16W
R22	ERJ3GEYJ242	Metal	2.4K ohms 1/16W
R23	ERJ3GEYJ683	Metal	68K ohms 1/16W
R24	ERJ3GEYJ223	Metal	22K ohms 1/16W
R25	ERJ3GEYJ270	Metal	27 ohms 1/6W
R26	ERJ3GEYJ332	Metal	3.3K ohms 1/16W
R27,28	ERJ3GEYJ222	Metal	2.2K ohms 1/16W
R29,30	ERJ3GEYK2R2	Metal	2.2 ohms 1/16W
R31	YWR1220P332D	Metal	3.3K ohms
R32	YF2116333GT	Carbon	33K ohms 1/16W
R33	ERJ3GEYJ472	Metal	4.7K ohms 1/16W
R34	ERJ3GEYJ332	Metal	3.3K ohms 1/16W
R35,36	ERJ3GEYJ392	Metal	3.9K ohms 1/16W
R37	ERJ3GEYJ620	Metal	62 ohms 1/16W
R38	ERJ3GEYJ332	Metal	3.3K ohms 1/16W
R39	ERJ3GEYJ102	Metal	1K ohms 1/16W
R40	ERJ3GEYJ392	Metal	3.9K ohms 1/16W
R41	ERJ3GEYJ472	Metal	4.7K ohms 1/16W
R42	ERJ3GEYJ100	Metal	10 ohms 1/16W
R51	ERJ3GEYJ511	Metal	510 ohms 1/16W
R53,54	ERJ3GEYJ333	Metal	33K ohms 1/16W
R55	ERJ3GEYJ101	Carbon	100 ohms 1/16W
C1	ECEA1CU101	Electrolytic	100 µF 16V
C2	YF400104FZT	Ceramic	0.1 µF
C3	YW5X102K5VB	Ceramic	1000 pF
C4	ECEA1HKS2R2	Electrolytic	2.2 µF 50V
C5	ECEA1AFS221	Electrolytic	220 µF 10V
C6	YF400A272XKT	Ceramic	2700 pF
C7	ECEA1EU101	Electrolytic	100 µF 25V
C8	ECEA1AU221	Electrolytic	220 µF 10V
C9	ECEA1CU101	Electrolytic	100 µF 16V
C10	ECEA1EU470	Electrolytic	47 µF 25V
C11	ECEA1AU221	Electrolytic	220 µF 10V
C12	ECEA1EU470	Electrolytic	47 µF 25V
C13	ECEA1AKS470	Electrolytic	47 µF 10V
C14	ECEA1AU470	Electrolytic	47 µF 10V
C15	YF400104FZT	Ceramic	0.1 µF
C16	ECEA0JS470	Electrolytic	47 µF 6.3V
C17	ECSF0JE476	Tantalum	47 µF 6.3V
C18	ECEA1CU470	Electrolytic	47µF 16V
C19	ECEA0JU101	Electrolytic	100 µF 6.3V
C20,21	ECEA1AKK100	Electrolytic	10 µF 10V
C22	ECEA1CU471	Electrolytic	470µF 16V
C26	ECEA0JS470	Electrolytic	47 µF 6.3V
C27,28	ECSF1EE106	Tantalum	10 µF 25V
L1	ELC08G010	Coil	100 µH
L2	EL05SI221K	Coil	220 µH
L3	ELC08G006	Coil	390 µH
L4	EL05SI221K	Coil	220 µH
L5	YFEL05SI2R2K	Coil	2.2 µH
T1	YWETE13Y57AY	Power Transformer	
CF1	YWELB4C016	Filter	
J2,3	ERJ3GEY0R00	Jumper Resistor	
J56	ERJ3GEY0R00	Jumper Resistor	
CN1	YW530202610	26-pin Connector	
M34	YWV2HA0494A4	Shield Parts	

MOTHER BOARD

REF.NO.	PART NO.	DESCRIPTION	
PCB5 (NLA)	YWVKYBL90E5A	Printed Circuit Board Assy	
C1,2	ECSF1AE106	Tantalum	10 µF 10V
C3	ECSF1CE106	Tantalum	10 µF 16V
L1-4	SP0305R68M2	Coil	0.68 µH
CN1	YW520221810	18-pin Connector	
CN2	YW520221410	14-pin Connector	
CN3-5	YW520222610	26-pin Connector	
CN6,7	EMCS0250Z	2-pin Connector	
CN8	EMCS0650Z	6-pin Connector	

CONTROL BOARD

REF.NO.	PART NO.	DESCRIPTION	
PCB6 (NLA)	YWVKYBL90P6A	Printed Circuit Board Assy	
IC1	NJM3414M	IC	
Q1	2SD601-RS	Transistor	
Q2,3	2SD602-QRS	Transistor	
Q4,5	2SD601-RS	Transistor	
Q7	2SD601-RS	Transistor	
Q8	2SB709-QRS	Transistor	
Q9	2SD601-RS	Transistor	
Q10	2SB709-QRS	Transistor	
Q11	XN6501	Transistor	
Q12	XN6401	Transistor	
Q13	2SB709-QRS	Transistor	
Q14	2SD601-RS	Transistor	
D1	MA4039H	Diode	
D2	HZ6C2L	Diode	
R1	YF2116332JT	Carbon	3.3K ohms 1/16W
R2,3	YF2116333GT	Carbon	33K ohms 1/16W
R4	YF2116750JT	Carbon	75 ohms 1/16W
R5	YF2116392JT	Carbon	3.9K ohms 1/16W
R6	YWR1220P332D	Metal	3.3K ohms
R7	YFR1220P104D	Metal	100K ohms
R8	YF2116392JT	Carbon	3.9K ohms 1/16W
R9	YF2116121JT	Carbon	120 ohms 1/16W
R10	YF2116682JT	Carbon	6.8K ohms 1/16W
R11	ERX1SJ2R2	Metal	2.2 ohms 1W
R12	ERG1SJ820	Metal	82 ohms 1W
R13	YF2116562JT	Carbon	5.6K ohms 1/16W
R14	YF2116102GT	Carbon	1K ohms 1/16W
R15	YWR1220P182D	Metal	1.8K ohms
R16	YWR1220P682D	Metal	6.8K ohms
R17	ERG1SJ820	Metal	82 ohms 1W
R20	YF2116101JT	Carbon	100 ohms 1/16W
R21	YF2116102GT	Carbon	1K ohms 1/16W
R22	YF2116222GT	Carbon	2.2K ohms 1/16W
R23,24	YF2116472GT	Carbon	4.7K ohms 1/16W
R25	ERDS2TJ3R3	Carbon	3.3 ohms 1/4W
R26	YWR1220P152D	Metal	1.5K ohms
R27	YWR1220P112D	Metal	1.1K ohms
R28	YF2116181JT	Carbon	180 ohms 1/16W
R29	YWR1220P361D	Metal	360 ohms
R30	YF2116103JT	Carbon	10K ohms 1/16W
R31	YWR1220P182D	Metal	1.8K ohms
R32	YWR1220P361D	Metal	360 ohms
R33	YF2116392JT	Carbon	3.9K ohms 1/16W
R34	YWR1220P512D	Metal	5.1K ohms
R35	YFR1220P222D	Metal	2.2K ohms
R36	YF2116132JT	Carbon	1.3K ohms 1/16W
R37	YF2116751JT	Carbon	750 ohms 1/16W
VR1	EVML3GA00B13	Variable Resistor	1K ohms
VR2	EVML4GA00B14	Variable Resistor	10K ohms
VR3	EVML3GA00B52	Variable Resistor	500 ohms
VR4	EVML3GA00B13	Variable Resistor	1K ohms
C1,2	YF400122XKT	Ceramic	1200 pF
C3	ECEA1AKA101	Electrolytic	100 µF 10V
C4	ECEA1AKA221	Electrolytic	220 µF 10V
C5	ECEA1CKA101	Electrolytic	100 µF 16V
C6-8	YF400101CHJT	Ceramic	100 PF
C9	ECEA1AKK100	Electrolytic	10 µF 10V
C10,11	YF400104FZT	Ceramic	0.1 µF
C12	ECEA1CKS100	Electrolytic	10 µF 16V
C13	ECEA1AKK100	Electrolytic	10 µF 10V
L1-4	SP0305R68M2	Coil	0.68 µH
L5	YWNL322R2K	Coil	2.2 µH
SW1	YWSSSS342L4	Slide Switch	
SW2	YWSSSS912L4	Slide Switch	
SW3	YWSSS912L2NH	Slide Switch	
CN1	YW530202610	26-pin Connector	
CN2	YWD4152N200	4-pin ALC Connector	
M35	YWV2SA1354A4	Mounting Plate	

PROCESS SUB BOARD

REF.NO.	PART NO.	DESCRIPTION	
PCB7 (NLA)	YWVKYBL20E9A	Printed Circuit Board Assy	
IC1	YWM51269FP	IC	
R1,2	ERJ3GEYJ242	Metal	2.4K ohms 1/16W
C1	YW5CH101J5VB	Ceramic	100 PF
C2,3	ECST1AC106ZR	Tantalum	10 µF 10V
C4	ECST1AD476ZR	Tantalum	47 µF 10V
M47	YWV2HA0701A4	Shield Parts	

ACCESSORY PARTS/PACKAGING PARTS

REF.NO.	PART NO.	DESCRIPTION
M51	YWV8QA1743AN	Operating Instructions
M52	YW-FP10	Lens Paper
M53	YWT20X25C03	Polyethylene Bag
M54	YWT20X35C03	Polyethylene Bag
M55	YWV9CA1261AN	Packaging for WV-BL90E
	YWV9CA1260AN	Packaging for WV-BL90F